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JOURNAL OF METHODS-TIME MEASUREMENT

In This Issue . . .

MTM

The Journal of Methods-Time Measurement

May-June
July-August
1959

MTM ASSOCIATION FOR STANDARDS AND RESEARCH

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MTM Association

Editor. . . . . .Richard F. Stoll

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MTM—TODAY

A COMPLETELY NEW PROGRAM

2 DAYS ONLY
October 1-2, 1959

SUBJECTS (PARTIAL LIST)

Why Did MTM Succeed?

Why Did MTM Fail?

A Look at Russian Industry

Labor and Management Looks at MTM

Train an Operator in Days, Not Weeks

Standard Data Developments

Measure Office Procedures

Computer Line Balancing Using Basic Time Data

AND MANY NEW FEATURES

MTM INTERNATIONAL

NEDERLANDS M.T.M. - GENOOTSCHAP

2nd International M.T.M.—Conference, Scheveningen / Kurhaus, april 1960
Secretariat: Nederlands Instituut voor Efficiency
436 Laan van Meerdervoort
DEN HAAG (The Hague) telephone 070 - 325972

R 274.2 GJL/MA
E 59 - 1136
annexe to E 59 - 1135

PRELIMINARY PROGRAMME

Monday 25 april 1960

9.00 hrs	conference secretariat open for registration of participants and distribution of documents
9.00	Reception (on special invitation) by the Council of the Nederlands M.T.M.—Genootschap
9.30 - 10.15	Conference opened by the President of the Nederlands M.T.M.—Genootschap, ir R.F. Volz, followed by an address by dr. H.B. Maynard, President of the International M.T.M. Directorate. Dr. L. Gilbreth will also be invited to address the Conference.
10.15 - 10.35	Screening of film "Predetermined Time Systems" (made by Stichting Technisch Filmcentrum, The Hague, in co-operation with the European Productivity Agency)
10.35 - 11.00	Coffee break
11.00 - 11.15	Division into groups under categories A (top management) and B (higher executives in charge of application of M.T.M.) for the second day (see programme for Tuesday 26 april)
11.15 - (12.30)	Official reception by Municipality
(12.30) - 18.30	Excursion to Keukenhof, bulb fields and North Sea coast (lunch at Keukenhof)
18.30	Return to Scheveningen Kurhaus. Dinner and discussions with members of the International M.T.M. Directorate, in which mr G. Bohlin will lead the discussion on Research; mr G.R.A. Lapoirie will lead the discussion on Public Relations; prof. W. Daentzer will lead the discussion on Instruction and Training; ir. W.B. Rueb will lead the discussion on Coordination of Examination Syllabi (Dinner and drinks not included in Conference-fee)

Tuesday 26 april 1960

Participants will have grouped into categories A and B (see programme first day, 11.00) as follows:

category A (top management) will visit a number of firms to exchange views on experience with M.T.M.: economy, industrial relations, methods improvement and training.

The following may be expected to act as hosts :
- mr P. Deiters (N.V. Berghaus Confectie - Clothing)
- ir. A.R. Blok (Fijn Mechanische Industrie - Precision Engineering)
- Schoenfabriek Welle (Shoe-industry)
- ir. A. Strachoff (Unilever)
- ir. Yap Kie Han (Research Instituut voor Bedrijfswetenschappen - Research Institute for Management Sciences)

category B (higher executives) will meet with executives from Dutch firms to exchange know-how of using M.T.M. by examining applications on the spot in a number of firms in the Netherlands.

(Forming these 2 categories is a possibility which, as you will understand, can only be realized when participation will be sufficient, resp. not "splintered up" too much.)

It is the intention to form working parties for several types of activity, to be selected — possibly the number (see below) increased if so desired — at a later date on the basis of participation in the working parties. Activities considered at present are

1. chemical industry
2. clothing industry
3. electrical engineering (appliances)
4. printing industries
5. office management
6. manufacture of small metal products
7. general engineering
8. maintenance
9. shoe manufacture
10. textile industries
11. market gardening (horticulture)
12. packaging

We imagine, that the discussions in the working parties be proceeded by an introduction by one of the participants concerning a special subject, e.g. in working party 2 :
a clothing industry in Sweden
b handbook for the clothing industry
working party 7 : M.T.M. in an engineering firm
working party 10: M.T.M. in textile industries

Brief reports from these working parties will be presented on the third day of the conference, and more detailed reports will be printed in the proceedings of the conference.

Conference participants belonging to category A may of course attend group meetings of category B if they so wish.

Wednesday 27 april 1960

9.15	coffee for invited guests
9.30	opening of secondary plenary meeting (cat. A and B together) by the president of the Nederlands M.T.M.—Genootschap, ir. R.F. Volz
10.00 - 12.30 (with a break for coffee)	Paper on "Standard Data" by...............(mr Strommenger, or mr Crossin or mr Birn) presentation of other papers, case histories and special investigations. Subjects might be : Problems of routine (e.g. dr ir De Jong, Bureau Berenschot) Coding (e.g. mr Bisch, Col. Jansen van Schoonhoven) .... (e.g................................ France) Adaptation blind workers (e.g. mr Bonneville, France)

	Use of M. T. M. in a Swedish plant (e. g. Evan Edman, Volvo Co.)
	M. T. M. in stationery & paper products (e. g. Simplex A. G. Switzerland)
	M. T. M. in training (e. g. Schiesser A. G. Radolfzell)
	Arbeits-technische Verbesserungen (e. g. Sulzer, Winterthur)(Methods Improvement)
	Structure and working method of the Swedish M. T. M. Association (e. g. mr Bohlin)
12.30 - 14.00	Lunch
14.00 - 17.00 (tea break 15.45 - 16.15)	Plenary meeting continued. Reports on the meeting of the International M. T. M. Directorate and the group discussions in categories A and B.
17.00	Conference closed
17.30	Social gathering (appetizer and a cold buffet)

Simultaneous interpretation will be provided on the first and on the third day of the conference, from English into French and German, from French into English and German, from German into English and French.

Depending on participation, a ladies programme will be organized for the second day of the conference.

Thursday 28 april 1960

Excursion to the Delta Plan.
Departure from Kurhaus approx. 10.00 hrs, return to Kurhaus approx. 17.00 hrs.

The Hague, august 1959

PRODUCT PLANNING — KEY TO CHANGING CONDITIONS

When the thoughtful businessman squeezes a moment for reflection from the hammering demands of daily decisions and deadlines, he can hardly help wondering where his company will be five or ten years from now. Given the quick-paced society in which we live, he is wise to be concerned with this question.

Looking back over the past fifty years at the nation's top 100 firms, one notes a startling turnover. Of the leading companies in 1909, two-thirds have since disappeared; of the top-rank enterprises of 1919, over half are now gone. To look at it the other way, of those that make up the 100 leaders today, the majority have arrived during the last 25 years. The ups-and-downs have been just as violent throughout the whole business community—small and medium-size companies as well as big companies.

Obviously the successful companies are those that were created or altered to meet the rapidly shifting demands of the market. In a dynamic economy, which bids fair to be dominated over the next decades by a rate of change far greater than that of the past, the enterprise that is not constantly on the move will be left by the roadside.

Keeping Up With Change

Are today's managers trying to meet this situation by fiddling around on the periphery of the problem? Many of them are trying sales gimmicks, tricky new packages, advertising approaches based on unverified speculations of untrained "social scientists," and so on . . . when they should be taking a sharp look at their products and their markets.

For the fact is that people's wants are changing Technology is making new items possible all the time. Even the functions which products serve for the customer are shifting. Automobiles, for example, may gradually be turning into mere means of transportation again, instead of symbols of power and prestige; while boats and swimming pools, once far out of reach for most families, are becoming devices to gain status as well as facilities for recreation.

So products, like humans, may have a life cycle from conception to death, and the company that relaxes because of the sales and profits of today could find itself with warehouses full of hula hoops or Davy Crockett hats tomorrow.

Success & Failure. How can a company manage to keep up? Obviously, by pruning out dead products and adding new products; by diversifying; by concentrating or broadening the appeal; by defining markets more clearly or expanding their boundaries—in short, by not being content with the *status quo*. More importantly, it can strengthen its basic situation by bringing into the management of the company the point of view of the customer and a real understanding of what the company and its products have to be and do for him.

If management attention today is more intensely concentrated on the development of new products than ever before, the reason is simply the tremendous potential profit and volume in new products. Studies in a number of industries indicate that new products are expected to contribute from 30 per cent to 80 per cent of total volume over the next five years.

But while the development and marketing of new products promise important volume and profits to those who succeed, the odds against the success of a new product today are higher than most businessmen realize. In fact, a frequently quoted observation that 80% of new products fail greatly underestimates the odds, since competitive pressures are becoming stronger all the time and the company that falls behind has farther and farther to go to catch up.

There are many reasons for a high rate of duds and misfires. Lack of coordination, especially between marketing and engineering, is a major cause. The failure of production-oriented top executives to measure the marketing needs of the product against the resources of the company; changed economic conditions or public tastes; poor executive judgment on the size or nature of the market; internal management rivalries and jealousies; too many decisions based on "intuition" without evi-

dence or solid argument to back them up—any or all of these can be involved.

Need for Policy. Underlying many of these difficulties is the lack of a clearly and generally understood method for selecting among the many alternative courses of action. In other words, there is no overall policy with built-in, specific measures by which management can determine whether to drop product X, pick up item Y by diversification, or continue with the development of project Z through R & D.

What is a "product policy," and how does management go about putting one together? Essentially, it is a statement of the characteristics of successful items, both now and in the future, for the particular company concerned which can be used as a measuring stick for additions, subtractions, and multiplications.

Before building such a list, managers have to come up with answers to three questions:

1. What do we think lies ahead for our company and industry, particularly in the market place?

2. What are the objectives of our firm, both short-range and long-range?

3. What are our particular strengths and weaknesses?

Let us look at each of these three areas in turn.

Gauging the Future

The first category of information managers have to assemble if they are to construct a viable product policy deals with what the future will bring. This is essentially forecasting, but looking around for the "building materials" for this purpose is a little different from pure economic predicting. The initial step is a sales forecast which rests on a consideration of general business trends, political and international developments, characteristics of the industry as a whole, the position of the particular firm in the industry, the direction of manufacturing costs, and, above all, the wants and needs of consumers and users. A five-year period is a useful one to choose, always remembering that the farther you get from the present, the shakier the estimate.

It is wise to rough out two predictions, one high and one low, since this kind of forecasting is hardly precise and most of us tend to weight our judgment on the optimistic side.

In today's world, sudden events can upset careful predictions with surprising rapidity. A far-reaching technological breakthrough may well occur in some industries during the next five years; or it may be a change in public tastes, another recession, or a major shift in the international picture. For "insurance" purposes, real thought should be devoted to the effect of developments like these, or others especially applicable to a particular company or industry. What, specifically, would they do to sales curves, and how quickly would their impact show up after the event?

Forecasting of this kind, one can complain, is not much more than educated guessing—and maybe not so educated at that. This is true, but it has to be done all the same since the decisions on product policy have to be based on expectations for tomorrow as well as the facts of today. The rough outlines of what is down the road are going to play a major part in determining the kinds of questions and answers in the area of objectives and company characteristics. If the possibility of different conditions has been foreseen, managers can plan for necessary adjustments in product policy, and can have alternative programs ready for implementation.

Furthermore, the exercise of looking ahead carefully is a healthy one, and may protect a company from being ambushed by a totally unexpected development along the way. Thus, predictions form the broad framework within which the product policy is set and implemented.

One final comment on forecasting: it calls for a high degree of executive skill and perception. Spotting all the possibilities, balancing them against each other, determining what policy shifts should be made in the event of major changes in the overall picture—all these demand judgment of a distinguished order.

Setting Objectives

Once the general conditions and possible variations have thus been determined, the objectives of the firm should next be added to the data from which the product policy will be drawn.

What does a company want to accomplish by changes in products or product lines? Generally speaking, growth, flexibility, and/or stability are the objectives. But a simple concern with any one or a combination of these three, even if weighted on the basis of the sales predictions, is not precise enough to be the basis of a product policy.

Some of the statements of goals which various companies have found useful as a basis for planning are these:

1. We want to make up for the coming obsolescence of existing items.
2. Our demand is sharply cyclical; we need to flatten it out.
3. We ought to be utilizing waste or by-products.
4. We have management, marketing, or production resources we are not using to the full.
5. We should be spreading our risk by reaching into several markets.

6. We foresee a change in the strategy plans of the government and want to be prepared to shift from defense work.

Some such specific objectives have to be pinpointed if a company is to have a sophisticated and really meaningful product policy which will serve as a firm guide in selection of new items and elimination or alteration of old ones.

Weighing Resources

Finally, a look at company resources is called for. What do we have to work with? To start with the tangible factors, an examination of the financial situation is important. How much money is available or obtainable? If a large amount of cash is within reach, new products or functional changes which demand heavy investment are appropriate; if it cannot be had, a firm has to content itself with items that do not require much by way of new facilities. It is interesting to note, incidentally, that even though a large concern has the capacity to take on low-investment projects, experience indicates that it will do better to leave such ventures to the small operator. Its heavier overhead and reduced flexibility may make it a poor competitor in a field where sales are small or margins are slim.

Another significant resource to study is the company's distribution channels. Too often production-oriented executives assume that salesmen can take on "one more product," or that the best test of a new product is whether or not it dovetails with available manufacturing facilities. Yet some specialists feel that it is far more important in launching a new item to make sure that existing marketing machinery is workable for it than any other single factor. Often the merchandising and distribution system is nowhere near as flexible as top managers believe.

Then, there are intangible assets: the flexibility of managers, the imaginativeness of researchers, the quality of personnel across the board. Closely interwoven here is the breadth and type of interests of executives. An art supplies company, for example, might find it economically feasible to go into the house-painting equipment business; but its executives could well be uninterested in that kind of endeavor.

Finding the Product

Once this material has been assembled—forecasts, objectives, resources—a pattern begins to emerge. A series of requirements for products and product lines, varying in importance, can be ascertained as company needs and capabilities become more clear. Some firms have found it helpful to draw out (a) a list of "required" characteristics for a product and (b) a list of "desirable" ones. Such a listing might look like this:

Required Characteristics (in order of importance)

Can be sold through current marketing channels.
Will counter our present cyclical trends.
Does not require large investment.
Will give us at least 20% of market.

Desirable Characteristics (in order of importance)

Will take advantage of current unused manufacturing capacity.
Will tie present customers to us more closely.
Will utilize present raw material suppliers.
Will give us broader product base in case of unexpected early obsolescence of present items.
Will stimulate sales of existing products.
Takes advantage of and will strengthen brand image.
Requires low-precision production.
Medium bulk size.
High value added by manufacture.

A policy like this can be stated as a check list, a series of questions, a formal policy statement, a series of brief definitions, or in various other ways. Some firms have prepared a comprehensive statement of their product policy, and supplemented it with a check list for ready use.

Implementing the Policy. The policy itself, however, is not enough; it has to be backed up with a process of implementation. In putting the product policy to work, a number of companies have found it advisable to ask themselves first, "Is this a situation in which product is the central issue?" With all the current popular talk about new products, diversification, and functional features, it is all too easy for a company to assume that one of these tools will open the locked box of treasure. Actually, cost control, greater efficiency, reshuffling of executives, or new marketing methods may be a more appropriate jimmy.

It is safe to say, however, that applying the litmus paper of a product policy to the existing line is a good idea under any circumstances. One company with annual sales of $40 million did just that, and eliminated 16 different items with a $3 million volume. Over the next three years, sales increased by one-half and profits by a factor of 20%.

Another corporation, one of the nation's largest, checked over its line only to discover that it was manufacturing one product with a market of $200,000 but a break-even sales volume of $216,000. Interestingly enough, the break-even point for a small firm on the same product was $55,000. The big company consequently let the item go.

Assuming that top management has concluded that new or changed products – acquired either through diversification, purchase, or internal R & D – is called for, the search begins. The executive judgment and talent has been geared into the process in the setting of the basic policy; the exploration can now be turned over to specialists who have

been equipped with map and compass. They would do well to start off with as wide a selection of ideas as possible, narrowing the list down steadily by matching it against the measure provided by the policy. Stiffer research and tests have to be applied at each step, until finally a handful of changes or products remain as candidates.

At this point, a more quantitative analysis in terms of the criteria is called for. To what extent does product X fit the standards established in the product policy? Does it meet the demands of the more important standards closer than it does the less significant? How much closer? Finally, some sort of test of return on investment might well be applied in an effort to make the final decision.

New Features. A word might be said about the particular problems associated with the development of new features or improvements for existing products. The same kind of rigorous thinking is called for here, since even what may seem like minor changes may have the effect of either expanding or shrinking the market for the product. Characteristically they have an impact on the market for the parent item which may or may not be in the best interests of the company itself.

Assuming of course that the feature is well engineered and will perform as the advertising claims, the general-interest feature will soon be duplicated by competition. This may well weaken its strategic usefulness for a smaller firm, while a larger firm may nonetheless consider it essential for maintaining leadership.

On the other hand, added devices of intense worth to one group of people in the general market can be of great value to the smaller firm. For example, a typewriter equipped with various accent marks would be in great demand by a limited number of people writing in foreign languages. Adding keys of this type might prove to be a wise move for a smaller concern, but uneconomic for a big company.

In short, features, too, have to be judged according to criteria which develop out of a look at a company's future prospects, its resources, and its objectives.

Schedule of Action

But the problem is larger than selecting a product or a set of new features. The schedule of action should provide for follow through. In full form it might contain these steps:

1. Start out with specifically defined objectives. Such objectives reduce the area of search and tend to make the entire program more efficient.
2. Begin with the company's existing business and work out from there. The more a product differs from the product the company knows best, the greater the danger and risks.
3. Make sure your new-product planning is customer-oriented rather than factory-oriented. Study and validate all basic assumptions before making extensive commitments. Recheck them as a precaution against obsolescence through market or competitive change if the time interval involved is long.
4. Carefully define and recognize the differences between present operations and the business which the company is entering with the new product. Efforts should be focused on launching the product into the market as it is, not as you may wish it were.
5. Maintain a careful schedule. Provide adequate time for market planning and market testing. Make your moves as slowly and deliberately as you can, and still keep ahead of competitors, so as to minimize risk and be able to gauge the market reactions over time.
6. Check results against forecasts as you go along, and take appropriate action when indicated.

Benefits of Policy

Some managers have expressed concern lest an orderly, quantitative, and qualitative set of measures—a formal policy, in other words—might limit the creativity of employees and douse the sudden flashes of intuition which have led to so many useful items. Actually, the reverse is true. Employees with ideas will have some guidelines to apply themselves, and they know that the final decisions will be made according to an impartial yardstick, not by the snap judgment of some manager higher up the line who got served cold coffee for breakfast that particular morning.

Furthermore, the greater range of possibilities and the orderly examination of them which the establishment and implementation of a product policy encourages is more likely to turn up a good answer—or answers—to the problem than a brainstorm.

It is true, of course, that a company can be successful without a formal product policy. But the rate of failure of new products and new features is so high that it seems unwise to ignore the potential of an organized and systematized approach. Furthermore, there are positive advantages to a well-understood, well-thought-out policy which should not be overlooked. It provides a frame for information top management needs on products; it gives executives a check on other control data; and it supplies a set of unifying goals to guide the whole organization. Viewed in this light, the rationalizing of a process that has been very much a "seat-of-the-pants" operation has much to recommend it.

FEATURE II

From presentations at 1959 Ft. Wayne AIIE Chapter Conference

CROSSING THE BRIDGE - SOME POINTERS ON GETTING ACTION

Frederick M. Gilbreth
IBM Corporation

It's a pleasure to be asked to address another AIIE gathering on the important subject of getting line managers to accept industrial engineer's programs. Because I have addressed your organization in various conferences some half a dozen times, I am in a quandary as to what, if any, results have been achieved. On the one hand, I would like to think that the "message" I have conveyed to some of your meetings has been so interesting that others, and now you, feel that you must have it at first hand. More realistically, I conclude that this subject is as wide open as it was when I first undertook to talk on it several years ago.

I concluded some years ago that industrial engineering means many things to many people. If you just read the table of contents of the McGraw-Hill Handbook you get a good example of the scope of industrial engineering: it is a composite far beyond the job of any single Industrial Engineer or department I am familiar with. Across the board, there is no uniformity in the type of work done by the industrial engineering department, no uniformity in the reporting relationship of the industrial engineering department in the plan of organization, no uniformity on the importance with which the industrial engineering department is viewed by top management, and no uniformity as to the internal organization of the industrial engineering department itself. Is there any mystery then to the fact that every industrial engineering department, to a greater or lesser degree, has difficulty having its ideas accepted and adopted? We have problems of gaining recognition and of earning a reputation. And we must excel in the fine art of getting people to accept changes.

It is not my purpose, today or any day, to argue the pros and cons of industrial engineering's reporting relationships or position in a company's plan of organization. Nor is it my purpose to take sides on the proposition that industrial engineering, representing the "scientific approach," should, per se, have ideas and approaches to problem solving that make adoption of its recommendations mandatory. Rather, I have described our position and its lack of uniformity in placement only to emphasize that we cannot rely on our job title to get our ideas acted upon.

Even without this advantage, our cause is not lost. However, there are some specific things that industrial engineers must really understand if they are to raise their batting averages in terms of getting their ideas accepted and acted on. The first of these has to do with recognizing that almost every industrial engineering recommendation has to do with a change, and that most human beings appear naturally resistant to change. Your wife probably thinks you are. But, as compared to the average line executive, you are probably quite flexible. One's willingness to accept and adopt change readily has been called a good test to determine whether a man should be in the line organization or in the industrial engineering organization. All of you here, being industrial engineers, may find it inconceivable to think that any man will resist change, but when you reflect on some of the things you see in your own companies, where the same job has been done in the same "backward" way for twenty years, I think you will have to admit that one reason is that the doer just plain resisted change. You must accept the fact that he has good reasons for this resistance in a country where change is the national way of life. It would be inconceivable to imagine that you were the first person in the last twenty years who had had an idea for improvement. Therefore, you must understand the conditions under which changes will be accepted and put this knowledge to use.

The second major understanding that we industrial engineers must have is what, in my business, we call the NIH philosophy. The letters, NIH, stand for "not invented here," and my experience as a management consultant tells that this is by no means an exclusive IBM property. Therefore, in order to get someone to change, one must make the change easy, either

in terms of getting the man to think or accept the fact that the idea was his, or by giving him some way to rationalize why the change, all of a sudden, is a very good idea. If you give the line an opportunity to save face, or perhaps better, an escape hatch, you will find less resistance than will be evident if you support a position merely by the facts.

A third understanding we must have is how to use logic as a weapon. Some of the successful consultants have developed this skill to an extraordinary degree. Consultants, as you know, are also merchants of change and one of the tricks of their trade is to present their case in a series of steps, each of which is so logical that the client agrees to it. In fact, many of the most successful consultants, during the presentation, use the question, "Does this make sense?" from time to time to obtain agreement as they go along. When they finally get down to the recommendation for action, they have, if they have handled themselves well, forced their listener to come to the same conclusion which they will then state. When they have done this thoughtfully, disagreement is virtually impossible. Of course, there is a wide gulf between acceptance of a recommendation and action on it, but acceptance is a good part of the battle.

The fourth area of understanding <u>and practice</u> is concerned with knowing what <u>you are talking</u> about and having the line's confidence that you do. One of the most successful proponents of change that I know joined one of the less successful auto companies after ten years with a leader. The immediate reaction of the line toward him was negative. Here, obviously, was a man who was an outsider who would immediately start putting his know-how to work. The fact that he subsequently did is <u>not important</u> to the point I wish to make. What <u>is</u> important, and why I call him a successful proponent of change, is that this man had the good sense to study the problem as it was evidenced in the new assignment. Only when he could factually describe the differences and similarities between the situation in his former company and the present one, did he know that he would have earned confidence. Having this accomplished, his proposals were accepted readily. His task was not easy. Those that were influential in having him hired wanted early action, and he also had to fight his own inclinations to establish a reputation quickly. The fact that he had the sense to stand off these pressures was the key to his success.

The last major understanding is concerned with line management's prerogatives to administer. Here our deportment alone is not enough. All of us have been told to work through the line management and the fact that we do so well is a prerequisite to our still being in the profession of industrial engineering. But to be really successful, we must do more than accept this modus operandi; we must understand why line authority rests where it does. Then we can guide our actions with judgment, rather than by following axioms, with better results all around.

So much for what we must understand. Let's get on now to the how-to-do-it part of the problem.

Getting people to accept and act on recommendations takes depth of understanding and experience in the fine art of persuasion. I assume that many of you are married. If you have any delusions that your getting that pretty girl to agree to marry a big lug like you was a demonstration of your powers of persuasion, I must tell you that you are completely wrong. The act of getting engaged is propelled by careful use of the powers of persuasion, but on that lovely moonlight night your wife's plan was being fulfilled, not yours. She understood the situation as every woman since Eve has. She had a campaign. And like yours, when you attempt to persuade the immovable to move, her campaign had five features:

1. A balance sheet of the pros and cons involved in making the move.

2. A complete marshalling of the psychological factors to induce action.

3. A carefully thought through and well-staged plan of action.

4. A program supported by specific steps designed to eliminate most personal doubts.

5. A planned flavoring of anxiety both in terms of the consequences of not acting and the hurdle ahead once a commitment to act is given.

I will leave it to your imagination to reflect on this analogy at some other time, and drop it here.

Let's examine these features in the business situation.

<u>First - A balance sheet of the pros and cons of making the change:</u> If your program is a sound one, most of the asset side of the

balance sheet will be the benefits you ascribe to your proposal. Of course, if there are any negative aspects, you must identify them clearly on the liability side. Many other features have both asset and liability facets. Every change has an impact on the knowledge that people must have to perform jobs as newly defined. On the asset side, people will learn new skills and be more valuable to the company. But on the liability side there is the confusion and slippage that may be occasioned while the new knowledge is being acquired and old knowledge subordinated.

Adoption of action programs almost invariably requires changes in the established working relationships among people. Both smooth working teams may disrupt (a liability) and points of present conflicts smoothed out (an asset). Deliveries may suffer during a period of change and the relationships between production and sales may deteriorate temporarily. Offsetting this may be an opportunity to introduce a whole series of product changes, both major and minor, that have been stymied up 'til now, which should gladden the hearts of the marketers. As in any other situation, there are factors that control and others that slave. But when getting someone to act, the importance of a complete inventory of the factors, with agreement on which control and which do not, is of tremendous importance. All of us have had the experience of seeing a beneficial recommendation get torpedoed on the basis of a seemingly trivial consideration —one that might have been avoided if a careful, complete balance sheet had been prepared and if early agreement as to its importance had been secured.

I do not believe it is possible to overstate the importance of a complete analysis of the problem, identification of the factors influencing and being influenced by the decision to act, and a thorough balance sheet describing the assets and liabilities of the move. The line should "audit" this balance sheet and agree to its accuracy. When liabilities are agreed to in advance they are less likely to be overemphasized later.

Second - Marshal the psychological factors: As the father of three children (and absolutely no ambitions to outdo my father) I have the problems of obedience and discipline. As I am sure each of you fathers have, I have gotten into a bind by ordering my children to do something about which Mrs. Gilbreth was less than enthusiastic. If the kids do it at all, they do it rebelliously when they sense that their mother is not convinced that it is sound. Obviously, I should clear it with their mother first. In the business environment it is equally important to have the leader strongly identified with the cause you champion.

It is human nature for an individual to act in the way that he believes his boss would want him to since he stands to gain by so doing. It is equally important to play on the fact that most people know that, long term, their futures are intimately linked with the fortunes of the company. This point was proved some time back when the labor local in American Motors accepted a contract that had less benefits than those demanded of the Big Three.

As one moves up in the echelons of management, this recognition of common fortunes grows. True, one will always find the situation where the individual accepts this concept, but thinks that delaying action will have no significant harmful effect. This can be overcome best, I believe, by judicious — and completely honest — citing of examples where others have gotten into trouble. Don't rely on such old ones as "for want of a nail," but make your examples relevant to the man's own position. And don't press the point to the degree where you force him to build up a strong defense position.

When you propose a change, be sure that those affected recognize that their true importance is not being diminished, if that is the case. One of the common points of resistance comes from the fact that many recommendations have the result that department heads will supervise less personnel than formerly. But, if you can make the head of the stock records understand that his job is to improve the accuracy of the records, get information faster that permits reductions in inventory and less probability of the assembly line running out of parts, and thereby render a greater contribution to profits than he did by supervising twenty clerks, you have the battle virtually won.

You should also convey the message that management looks favorably on men that are adaptable to change. Give the man assurance that there will be adequate time to learn the new skills and play on the fact that one of the key questions always asked before a man is promoted is his ability to adapt himself to new situations.

In making a recommendation for action, you should come to the point on a carefully thought through basis. You may elect using logic as a weapon, as described earlier, or you may use the approach of requesting that you be "heard

out" before any discussion is involved. This latter approach requires that you explain the whole program without giving the listener the opportunity to question certain aspects as you go along.

If your experience parallels mine, you have found that there are a variety of ways to present any recommendation. You can build a case and come to a conclusion on the one hand, or state a conclusion and provide it support later on the other hand. And there are a variety of alternatives between these extremes. The problem is that there are usually a number of things that must be understood before the reasonableness of a recommendation becomes clear. All the news in the paper cannot literally go on page one.

The advantages of telling the whole story without interruption are obvious. If you do it well, a great many questions that might be raised early in the presentation are answered as you go along. Your listener does not run the risk of asking naive questions nor does he run the risk of saying things that may force him to take a position that you do not want him to. And if your recommendation is thoroughly thought through and presented well, you have a distinct psychological advantage in that you may look like you know much more about the advisability of taking action than your listener does.

In getting real acceptance for change, you must provide the atmosphere in which relationships that are to be severed can be broken completely and adequate opportunity for new ones to be established. To a degree, establishing new relationships is like gluing a new brace into a piece of furniture — new glue will not hold unless all the old glue has been removed.

You should marshal the four components of learning if you want your listener to agree to make a change. Briefly, these are: Be sure that there is some drive or motivation to learn. No one will take the trouble to learn unless he wants to or recognizes that he must. Provide time for a man to understand the mores of the situation that he will be projected into. The learning process requires general familiarity with the broader aspects of the problem. If, in the change, your man must learn something about accounting, he will do so more readily when he knows what sort of an accounting system the company uses and the specific facets of this broad field that he is to become conversant with.

Next, make it plain that there will be opportunities for response. Sitting and listening are usually not enough. But provisions for discussions in depth, and for practice, experiments, and pilot tests will make a man more receptive to making a change.

Finally, provide a reward. Often this cannot be financial. But there are the other rewards of efficiency that adds to company profits, levelling of work loads, etc. with which your man can identify himself.

The last psychological factor I wish to bring in is the necessity that you identify the line problem clearly as your own also. This is not specious, as long as your advice is given within the scope of your job. The important point to be made here is that you feel an equal responsibility for success, over the long term, as the line does now. There is nothing in business quite so forlorn as the line operator who agreed to a program, finds that it is not going well, and feels that he was "run out on."

<u>Third major point - Develop a well thought through and carefully staged plan of action</u>: Here is where you put into action both what the line is to do and what you plan to do. The first area of planning has to do with the way the program will be publicized.

The presentation should be geared to the nature of action required. Programs that can be made effective virtually overnight call for one sort of presentation; those that will require months to accomplish and at the time of release, still require a lot of details to be resolved require a markedly different one. Perhaps the worst mistake that could be made is to have a "hoot and holler" sales-type meeting to generate enthusiasm for a program that will be months in accomplishment.

In every case, the "staging" is important. By staging I am not talking about the atmosphere in which programs are publicized, but rather the roles to be played by key personnel. In some cases it may be important for the key man to say "that is it." It is easy to imagine others where it would be more appropriate for him to take the part of a doubting Thomas and spur subordinates to amaze him with their superior performance.

These considerations apply equally to the events that precede and follow the announcement of any new concept. Consider, if you will, the campaign used years ago by Kraft Foods in introducing Miracle Whip Salad Dressing where the public appetite was whetted for weeks before the product was introduced. It met with tremendous

acceptance. On the other end of the line, reflect on the number of times where an idea that was almost rejected in the beginning finally gained acceptance by virtue of continuing efforts — all in accordance with premeditated plan. If we ever have nationwide prohibition again, this is how the "drys" will put it across.

In the presentation and in the work that follows to implement the program, the participants must understand what they are to do as precisely as it is possible to tell them. While it is mandatory that they understand the overall philosophy and objectives, this is not enough by itself. They must also understand what they will be doing during the implementation stage and how their work relates to that of others. This is no less important during implèmentation than it is at any other time, although I regret to say that this is slighted all too often. If you are to have a plan adopted and operating, you may as well accept the fact that putting a recommendation into being is more difficult than determining the direction initially.

From my background as a management consultant, I can say humbly that there were very few times when I had an idea that was totally original; virtually every recommendation for change that I have ever made I heard from at least one place in the client organization. My performance was never heavily evaluated on the basis of my ability to get ideas for improvement, although that was important. Rather, it was rated on the basis of getting clients to take action. The former is like making first downs in football, but scoring involves getting action.

Point four — Support your programs with specific steps designed to eliminate most personal doubts: I have talked around this point before and segregate it only to discuss a technique that I have found particularly effective in getting action. Almost every major recommendation that we make calls for changes in working habits and working relationships. Normally, we then draw up revised organization charts and job descriptions and revise company manuals and procedures guides. I think these are all fine and should be done.

I have found it advantageous to take one more step and prepare charts showing the way responsibilities will be distributed after the change is made. These charts supplement organization charts, job specifications and procedures manuals in an important way since they deal with activities that must be performed in a business. To be completely helpful, you should talk about such real activities as product line planning, quality assurance, pricing, etc., and point out specifically what each man's responsibilities are. No man is as frustrated as a man with line experience put into a new job without being given clear understanding of what he now does and how "things" get done.

The way I do this, although mechanics are unimportant, is to take a large piece of paper divided into squares and list the key activities that must be performed along the top and the job titles of the key executives down the side. Then, in the appropriate box, and in collaboration with the man involved, I write down the specific responsibility each man has for each activity. This helps to avoid conflicts, duplications, and omissions in coverage, and gives each key man (and me) complete understanding of what he will be doing. I commend this practice to you.

Fifth point - Leave some anxiety in the picture: I believe a certain amount of anxiety toward any change will always exist. If it cannot be eliminated, it should be controlled and allowed to work for some good ends. I have a Southern friend who describes this as "riding the devil your way." I happen to be one who feels quite strongly that anxiety can be a powerful force to get worthwhile programs accomplished. For example, fear of the consequences of failure can be a powerful goad to success. Think carefully about how you can harness this natural reaction and you will add to your arsenal of weapons to get people to accept and act on your recommendations.

And now, a word of caution and a charge. If you do not use the approaches I have outlined with thought and care, you will almost surely come to grief. But, thought and care are alone not enough. You must have other characteristics and qualifications if you are to be successful in getting action. Here are some of these characteristics and qualifications.

1. You must have the intellectual honesty to think a problem through logically and analytically. Don't be mesmerized by persuasive powers and use them before you have a solid program. And do not let others stampede you into doing so.

2. As industrial engineers and staffers without line authority, you must highly respect line management. I mean respect, not pay obeisance to. When you honestly respect something you will treat it properly. When you do not, you are in no position to properly persuade it to do anything.

3. Your proposals must be sincerely and

objectively made, based on the soundest thinking that you can command. If your proposals are anything less than honestly made and for the good of your company, if you are bearing a subjective standard for yourself or some other individual, or if you have compromised an important principle - then using the tools I have described will surely get you into real trouble. These are the same for good as for evil and you have a professional responsibility to use them only for good ends.

Earlier I pointed out the anomaly of resistance to change showing up in many places despite the fact that ready acceptance for change is deeply imbedded in the American way of life. Planned obsolescence works in motor cars and other fields too numerous to mention. The atmosphere is such that we industrial engineers have tremendous powers to effect changes that strengthen our companies and, through them, our Nation. Let's use them advantageously and wisely.

FEATURE III

From presentations at 1959 Ft. Wayne AIIE Chapter Conference

MASTER CLERICAL DATA

A New Approach to Clerical Work Measurement

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The subject of my talk today, Master Clerical Data, can be very easily described. Master Clerical Data is nothing but a list of Standard Elements which we believe covers 95% of the non-creative manual activities performed by office workers, and an accompanying method for establishing standard times for machine operations. Standards wise, we are, with MCD, in a position in which most of you have found yourselves at one time or another. You have developed data rather steadily for the manual part of the operation but you have found it somewhat more difficult to arrive at a measurement of the machine.

In the case of MCD, measuring machine times, is not a problem in technology. Where we must develop machine data, we find it fairly easy to do. The problem is simply that of waiting for the problem to come to one.

The ordinarily enthusiastic analyst will respond immediately "Yes," when asked if he can measure office work with MTM. Undoubtedly he is right. MCD has proven it. There are, however, many differences between the measurement of office work and the measurement of factory work which are not readily apparent and which can lead to unnecessary difficulties if they are not understood and allowed for. This is not just another way of saying "our work is different," or "MTM will work in the factory because it was developed on drill presses, while office work is principally handling and manipulating papers." These difficulties arise instead because of a basic difference in the purpose of office and factory work.

The factory generally has as its purpose the producing of something that can be sold. The office has as its purpose, the producing of the history of that production, MCD has proven beyond any doubt that the office worker accomplishes his job with the same motions and motion times as the factory worker. He is simply doing his job for an entirely different reason.

In the measurement of office work, this can be both a tremendous advantage and a handicap. Let's consider an analogy in which MTM is not involved at all. Work sampling is generally recognized as a universally applicable technique since it involves nothing but the law of averages and statements of probabilities. Application of work sampling to the office, however, involves completely different techniques and approaches than in the factory.

Again, this is due to the nature of office work. Much office work involves communication between people (either verbal or written). Very little factory work requires it. Accordingly, when conversation in the factory is observed, a good bet is that it is a voidable delay. This is probably a good bet in the office as well, but it is certainly not a sure thing. The reasons for this should be obvious. A telephone is the city order clerk's machine—without it, he could not perform his job. Yet, how do you classify a telephone conversation, as observed in a work sampling study? Is the city order clerk taking an order? Is he checking a specification with the plant? Or is he talking to his girl friend? If he is checking a specification with the plant, how much of his conversation concerns the specification in question, and how much concerns the company bowling league or office picnic? Short of wire tapping, which is illegal, I know of no particular good solution to this problem.

More or less similar difficulties surround work measurement in the office. To begin with taking as an office force all jobs from comptroller or Treasurer to office boy—only about 50% of office work is measureable. I mean in this case, measureable from both an economic and

technical standpoint. Technically, any non-creative job can be measured. Economically. a great many can't.

Where creative jobs are concerned, it is ridiculous even to try. Even on some non-creative jobs, you don't. For example, you don't, in 99 cases out of a 100, measure the work performed by the Executive Secretary. Her particular job is to be available. She may have only one hour's work a day, but her value to the company is her availability at any given instant to do that one hour's work. It is probably a waste of time for me even to mention the fact that you do not attempt to place Standards on the public relations men, the tax attorney, or the personnel director. There is no question in my mind but that we never will measure such activities.

The first difficulty that we encounter when we attempt to measure office work is the office worker himself—not to mention his supervisor. Office workers do what they do principally because of motivations entirely different from those of the factory worker. If they weren't different, they would be factory workers. Where factory workers sometimes insist on work measurement, office workers generally resist it unless it is a completely unobstructive technique that does not affront the "dignity of the individual." This virtually rules out time study in the office. Office supervisors, certainly to no lesser degree than factory foremen, tend to defend their employees before the work analyst. Probably, they are no better and no worse in this respect. As a rule, they have come up through the ranks in the office just as the foreman has come up through the ranks in the factory, and their attitudes toward "outside experts" is about the same. If you have encountered this attitude in the factory, you know precisely what I mean.

This whitecollar attitude generally limits, if not eliminates, the use of incentives in the office. If you contemplate a program of office measurement, you would probably be wise to limit your objectives to measured day work or measured labor budgeting for this reason. The exception to this is, of course, the mail order house of one kind or another. In such cases clerical work becomes the counterpart of factory work, and incentives can be and are readily applied. Oddly enough, incentives—or even measurement for that matter—are not widely used in the insurance industry, which on the surface would appear to have about the same type of activities.

Another adverse factor affecting the use of office standard is the nature of a great deal of the measureable activity. Many office workers perform 8 or 10 distinctly different jobs and may perform them with varying frequencies from day to day. Consequently, the administration of office standards—keeping account of who did what —becomes an economically impossible task. This, in the factory, causes no particular problem, because it is easy enough to count who did what. The result of the factory worker's effort is usually something you can see or feel. You can count it and you can identify it. But how do you determine economically who made what entry in a kardex file of 15 or 20 thousand items; or, for that matter, how many entries were made at all? The answer is—you sometimes can't. Consequently, in developing his standards the office work analyst must depend for his frequency information on "what have we done before"—rather than on "what are we doing now."

This brings into the picture a very important positive factor for development of office and clerical standards. The office work analyst has at the fingertips something that is not available to the factory work analyst—a complete history of what was done, including quantity of work, methods by which the work was done, where, as a rule, only quantity information and sometimes not even this is available in the factory.

This history is available to the office work analyst to assist him in the solution of the problem of frequency. If he has done his work well, frequency is the only problem to be solved in establishing a performance standard. (This incidentally is true of factory and office both.) Let me elaborate on this point. I believe that in properly engineered data there is no such thing as a variable element. There are constant elements which occur with variable frequencies. This may sound like an elegant point, but it is, in my opinion, extremely significant. Standard data containing no variables can be applied by solving only one problem—not what, or how fast, but how often. The problem of HOW OFTEN is emphatically more easily solved in the office than in the factory because of carbon paper, ditto masters, and mimeograph stencils.

Because of these and other techniques of reproduction, the office work analyst has at his fingertips, (in the form of copies), a complete history of everything that has recently been done; when it was done; how it was done; how often it was done; and even if he wants it, who did it. With the exercise of a little ingenuity, he is rarely required to establish frequencies by observation. Instead, he pulls representative records of past operations from the files and

determines his frequencies, in many cases, without leaving his desk. A surprising number of frequencies can be determined by a simple telephone call to the statistical section of the data processing department. Perhaps an example would be in order:

Let us suppose we are investigating a routine machine billing operation. If my data has been properly developed for the billing machine in question, I am concerned with such questions as "how many characters typed?", "how many lines of typing?", "how many tab key strikes," "how many price extensions?", and "how many separate items per invoice?". There are others, but no matter. To determine these frequencies, must I sit in a billing department and look over the billing clerk's shoulder for 8 or 10 hours? Certainly not! All that I need do is call the central files—ask for the files of all invoices for the months of November, April, and August, for example, and at my desk determine the above frequencies directly from this fund of history.

If I wish to know what percentage of my incoming orders are C.O.D., Cash Sales, or Payment against Outstanding accounts (each procedure will involve a different number of manhours for processing) I simply pick up a telephone, call the sales department or statistical section and have the answer in less than 5 minutes. Such an approach is generally impossible where factory work measurement is concerned.

There is one other area where office work measurement differs in degree, but not in kind, from factory work measurement. Office work measurement depends much more than does factory work measurement on probabilities. I make this statement with some reservation, since it is my opinion that most of us do not realize to what extent we depend on probabilities even where highly repetitive operations are concerned. Let me emphasize this by making what may sound like a rather startling statement.

Except on an operation involving only a few motions (and by a few I mean something less than fifty), it is highly unlikely that any operator will ever in his lifetime perform his job in exactly the same way twice. Now, where we are talking about a highly precise tool of measurement such as MTM, this may sound like heresy; especially, in view of the statement that we have heard so many time "MTM both permits and requires an exact description of the method." I would be a great deal happier with this statement, and I believe it would be a great deal more realistic, if we said "MTM both permits and requires an exact description of the probable." I would like to develop this theme a little more if I may.

Let's consider a "short cycle" operation involving, say, 30 motions. This operation will include representative hand motions, a few limiting motion patterns and varying degrees of mental, muscular or visual control. Now, we know, for example, that our MTM performance times represent the averages of various ranges. We know, for example, that PSIE time of 5.6 TMU is an average of observations from approximately 4 to approximately 7 TMU. In the true sense of the word "exact" then, to ask an operator to perform a 30-motion operation <u>exactly the same way</u> twice in his lifetime would be <u>asking him to perform</u> 30 motions in exactly the same way within a range of possible performance times including limiting and combined motion complications, this would be asking him to do something the probability of which is on the order of 30 times 29 times 28 times 27 and so on. Perhaps you think I am being overly scientific with this analogy. In reply — I can only say if we are to use the word "exact," we had better use it exactly according to its meaning. Either that, or we must accept the fact that "exact" is only exact by comparison.

In measuring office work, one either accepts this lack of exactness or gives up. Perhaps what I am trying to say is this — unless you are willing to accept the fact that no office worker will ever do his job as you have said he should and unless you believe that he will probably do it "almost" as you say he should, office work measurement is a good field to stay away from.

Actually, unless we accept this proposition, we are saying to the world "MTM is a more exact and more precise measuring device than any other in current use today by any other branch of the engineering profession." Let's not kid ourselves for a moment on this score. The principle that I am talking about, that of "compensating errors" is fundamental to every branch of modern technology — even the study of sub-atomic particles if you wish. When you buy a modern automobile, for example, you are to some extent relying blindly on compensating errors to give you a serviceable car instead of a "lemon." Compensating errors virtually guarantees that for every short connecting rod there will be a long piston — for every flat cylinder head, there will be a high block. By the same token, MCD assumes that for every "short" pickup, there will be a "long" aside.

Now that I have introduced MCD directly

with this analogy, let me explain the procedure in greater detail.

I have already told you what MCD is. My description — "a list of standard elements" — generally tells the story. There is one particular feature of MCD, however, that I want to bring to your attention. This feature is our category of "general elements."

To us, elements are of two types. There are elements which may be used anywhere in the office. They are common to many different kinds of work, and have general application. Therefore, "general elements." All other elements we class as "special" elements since they are used only in special situations or are peculiar to a particular activity. I mention this because the use of general elements is basic in all of our work measurement activities. The principal advantage of general elements is that they reduce the volume of data and tend to keep it manageable.

I believe this was best expressed recently by a member of our staff when he said, "Standard Data is only as good as your memory." To paraphrase this, let me say, "a standard element is no good if you can't find it." General elements, since they replace literally thousands of specific elements, help to solve this memory problem. In Master Clerical Data, for instance, two general elements "Pick up small easily grasped object" and "Pick up small difficult to grasp object" combined with the general element, "Move small object aside," cover a good 10% of office activity. Certainly many other elements occur with them, but simply picking up and laying things down occupies a good 10% of our office force. If we choose to classify picking up as special elements, then we have "Pick up pencil," "Pick up eraser," "Pick up stapler," "Pick up staple remover," and so on, through as many things as there are to be picked up in the average office. I think the complication here is obvious.

Where general elements cannot be used, a special element is synthesized. An example— "Tap space bar first time" or "Tap space bar each additional time." The catalog of these elements, general and special, constitute Master Clerical Data or MCD.

"Special" elements generally are always found where machine operations occur. In this connection, you might be interested in seeing how we solved the problem of manual and electric typewriter-key-stroke times.

In the passout material you have is a chart headed OT203 — Analysis of Manual typing times and accompanying motion patterns.

This chart shows how we have analyzed the motions involved in making various kinds of key strokes, and how they were weighted by checking sample letters to arrive at an average key stroke time.

This average key stroke, by the way applies only to routine correspondence. For technical reports on inter-office memos different frequencies are encountered and different key strokes times are required.

Now a final word concerning the economics of MCD. Experience on every type of office activity — from the highly routine to the highly complex — shows that standards can be set at an average rate of 2.5 engineering days per person. This of course, is a broad average, but it holds up in practice. Its significance to us is that at this rate of average, measurement becomes practical on activities that in the past have been bypassed or ignored because sheer cost prohibited measurement.

FEATURE IV

From presentations at 1959 Ft. Wayne AIIE Chapter Conference

The POSITIVE APPROACH TO WAGE INCENTIVES

Charles Winkleman
Management Consultant

INTRODUCTION

The principle of wage incentives is sound but the practice in too many instances is not.

If we are to reap the full benefits from wage incentive, we must remove the causes of poor practice.

If this were an easy task, there would be very little need for our discussion today.

Many of the factors that affect the operation of wage incentives appear to be beyond our control.

Thus, we have grown accustomed to living with the headaches and poor performance of incentives.

Wage incentives affect organization profits and employee welfare to such a degree that we cannot afford to tolerate anything but the best performance.

In the "Positive Approach to Wage Incentives," we do not accept conditions as they are but find a way to correct the deficiencies.

I have discussed wage incentive problems and their causes with many industrial engineers. Their experience has paralleled mine and I am sure is typical of the situation for many of you.

At the top of the list are these problems:—

Misuse of incentives
Incorrect standards
Inadequate maintenance
Incomplete coverage
Indifferent shop administration, and
Too many grievances.

The problems originate from:—

Unsound wage incentive concepts.
Faulty industrial engineering practices.
Policy established by poor past practices.
Shop methods not standardized.
Inadequate worker training.
Special rates.
Excessive allowances.
Incorrect time and production reporting
Non-co-operative incentive workers.
Insufficient industrial engineering manpower, and
Weak management support.

This situation presents the industrial engineer with dilemma.

He is responsible for correcting the wage incentive problems - yet the causes for most of the deficiencies appear to be beyond his control.

He may resort to selling programs in order to obtain the support and co-operation needed to eliminate the problems, but, in most instances, this is not fully effective.

In addition to the known causes of deficiencies, there may be others that are unknown. These, too, will have to be eliminated if peak wage incentive performance is to be obtained.

Enlisting management support for correction of the known causes and determination and correction of the unknown causes may best be solved by making an audit of the whole wage incentive system.

The right kind of an audit permits viewing wage incentives and their deficiencies in their true perspective.

Let us discuss what we should look for in an audit.

AUDITING INCENTIVES

A wage incentive system is usually composed of several individual plans. Although they are alike in principle, they vary in detail and performance. We must examine each incentive plan

as a separate unit and let it stand or fall on its own merits before attempting to evaluate the total system.

Management expects incentives to increase production and reduce costs.

a. The incentive workers expect to be paid fairly for their extra effort.

b. If an incentive plan favors either group, it does so at the expense of the other group and, in the long run, the interests of both groups will suffer.

   (1) We must not lose sight of this fact while making the audit.

I suggest we use the following questions to guide us in our auditing:—

1. Does the incentive plan increase production?
2. Does the incentive plan reduce costs?
3. Does the incentive plan pay people fairly?

We will discuss each question in turn.

First the question—Does the incentive plan increase production?

The increase in production output over that which could be obtained with a day work payment plan is the base and justification for incentive premium payment, except in the relatively few instances where the purpose is to reduce spoilage, increase raw material yield, or similar advantage. When we audit incentive plans to determine whether the production increase is up to expectations, we should also examine the method of production measurement to determine that it truly indicates worker performance. We should be on the look-out for machine or conveyor paced operations on which the workers have very little or no control over production output.

Incentives are not justified if their purpose is to increase production and they do not do so. Yet many installations have been in the mistaken belief that, because incentives paid off on one type of work, this should also be true for other work.

We should also be on the look-out for operations whose production output is determined by that of an associated operation because direct measurement is not possible—if there is not a direct relationship in the production rates of the two operations, it is possible that incentive premium may be paid without a corresponding production increase.

The accuracy of time and production reporting plays a big part in the measurement of production performance. Incorrect reporting may go unnoticed if periodic audits are not standard practice. When we seek the answer to the question—Does the incentive plan increase production?, we should assure ourselves that the production figures are reliable.

The second question was — Does the incentive plan reduce costs?

The difference between incentive cost and the estimated cost for operating under a good day work system is usually considered the cost reduction contributed by incentives. If we establish a standard expected cost reduction percentage, we have a means whereby we can estimate the loss caused by a plan that is not performing up to expectations. If we want to brag about incentives, we can talk about the cost savings. If we want to enlist help in improving incentives, we should talk about reducing the losses.

It is obvious that we should charge against the cost reductions attributed to incentives, the cost of installation and maintenance, but we frequently overlook the hidden costs of industrial relations problems and method improvement handicaps that accompany incentives. Hidden costs may cancel out the measurable savings and should not be ignored just because they are difficult to find and measure. Hidden costs that cannot be isolated and billed directly to a single plan, should be charged against the total cost reductions credited to the whole system.

Our final question—Does the incentive plan pay people fairly? must be asked from the viewpoint of the incentive worker.

Too often we look at earnings averages and, if they appear to be in line, we stop there. The individual incentive employee is not interested in averages, no matter how fair they look to us. His concept of fair is based on what he makes from one job to another and the relation of his total earnings to other employees. Fair pay requires that each individual employee receive an incentive premium in proportion to his extra effort — no more — no less.

Overpayment is a more serious problem than underpayment. Low incentive standards are usually increased by pressure from the employees. High incentive standards are so difficult to adjust that they are likely to go unchanged.

Incentive employees feel that it is unfair for their fellow workers to ride the "gravy train" when they cannot. Their confidence in management fairness is shaken and they will take whatever action they believe is necessary to protect their own interests. They may restrict production on jobs with high standards. They may restrict production on all their work if they believe that other incentive employees do not have to work as hard as they do, yet make substantially more incentive pay.

If incentive employees as a group are overpaid in relation to the day work employees, the pace of the day workers may be affected for they, too, feel that they are not being treated fairly in relation to their fellow incentive workers. This productivity loss is an indirect incentive cost.

Obtaining correct time and production reports from employees is always difficult. It may become a serious problem when incentive employees feel that they are not fairly paid, for they are likely to feel justified in falsifying the figures.

Employee dissatisfaction with the fairness of incentive pay may go beyond its effect on production. Employee may resist methods improvements and be non-cooperative in maintaining quality, reducing spoilage or providing proper care of machine tools. Employee relations suffer and sometimes the situation becomes so critical that it leads to strikes. Handling the additional wage incentive and employee relations problems takes management time away from constructive work. Management, to avoid additional employee relations problems, may feel compelled to hold up methods improvements, new machines and processes that would reduce costs. These interferences are hidden wage incentive costs. Thus, it is apparent that fair pay is of equal importance to both management and workers and is vital to successful wage incentives.

OBJECTIVE APPRAISAL

In developing a plan for auditing and improving incentives, I believe we should consider the following features:—

First: That we must be on guard not to rationalize our current position. We must keep our personal feelings and prejudices in the background.

Second: We should be willing to consider using other types of wage payment plans when a deficient incentive plan cannot be revised to meet the three tests of good incentives.

Third: That operating management should participate in the audit and evaluation of improvement proposals. Wage incentives have such an effect on productivity and costs that it is to the best interests of operating management to help improve them. Their specialized knowledge and different viewpoints are particulary valuable in determining the operating problems and the magnitude of the hidden wage incentive costs. Because of their participating in the audit and approval of improvement proposals, they will give their full support at the time the improvement revisions are made.

I call this approach to auditing and improving wage incentives—"An Objective Appraisal." Appraisals have to be tailor-made to fit each organization's specific conditions, however, the overall procedure is the same for any appraisal.

In the first step, we collect all the pertinent facts that will enable us to audit the incentive plans individually and collectively.

We talk to workers, foremen and managers to obtain their opinions. We are interested, at this stage, in what people think, not whether we think their beliefs are correct. Evaluation of opinions and development of a plan for correcting wrong beliefs is at a later stage in the appraisal.

We then prepare a performance record for each of the incentive plans. Included are the production and earnings figures both averages and extremes. Problems such as poor incentive coverage, excessive allowances, special rates and incorrect time and production reporting are recorded. Clerical time for the routine computation of incentive earnings and productivity records are estimated and recorded for later use in determining incentive plan costs. The number of people covered by the plan and an estimate of industrial engineering manpower required for plan maintenance is also included for later determination of costs and excessive maintenance.

In the second step, the collected data is analyzed and the performance for each of the plans and the entire system is evaluated.

Evaluation of each plan's performance is largely a matter of good judgment. The three tests of good incentives will serve as a guide. We must be careful not to overlook charging all incentive costs against the direct cost reduction. Listing the deficiencies aids the evaluation and helps later in developing the improvement proposals.

When we have completed the evaluation of the individual plans, we are in a position to evaluate the system as a whole. Our most difficult problem is estimating the hidden costs that could not be charged against the individual plans. The estimate will not be very accurate, however, a guess is better than ignoring the cost of industrial relations disturbances and the losses encountered because methods improvements were held up by incentive problems. If incentive earnings are so far out of line that the day workers have reduced their pace below that expected, because they feel they are not treated fairly, an estimate should be made of the loss.

Next, the cost reductions for all the plans in the system are totalled and compared to the total of the hidden costs and day work pace losses. If the cost reduction total exceeds the losses, incentives are paying their way. This is usually the case, but when it is the other way around, it is time to consider a change in the wage payment system. If the wage incentive system is repaying its cost, we should then determine the loss that occurs due to its falling short of expectations. This is the profit loss caused by the shortcomings of the system and is also the cost reduction we hope to achieve by making the improvements. This figure can be quite substantial, even for what is thought to be a reasonably good wage incentive system.

In the third step, we develop proposals for improving the wage payment system.

Our analysis step has told us what is wrong with each of the plans. Now we must determine what should be done to improve each one. We may find that some plans need only maintenance work to bring them up to date — others may need complete revision and there may be a few plans that should be replaced with a different type of wage payment. When the choice between complete revision and replacement with another type of wage payment plan is not clear cut, alternate proposals should be made.

Proposals should also be made for correcting the causes of wage incentive problems that are not inherent in the incentive plans. Examples are: unsound incentive concepts; shop methods, special rate and allowance practices; and poor time and production reporting.

At this stage in the appraisal, it may be found that the whole incentive system has deteriorated to the point that rebuilding it will take too long or still not provide good incentives. We may not want to believe that such a situation could arise, but, if it does, we should not hesitate to include in our proposals recommendations for changing over to a more suitable wage payment system.

The fourth step is evaluation of the improvement proposals. Here we receive the assistance of key management men. The size of the job should determine who these men should be.

If the proposals cover only a few operations, then the appraisal team need include only the heads of the departments involved. If policy is involved, then the industrial relations department should have a representative. If the proposals are plant wide in their scope, the appraisal team should include the top men who have the authority to make major decisions. Examples are:—

General Manager,
Division Manager,
Superintendent,
Production Scheduling Manager,
Industrial Relations Manager and, of course
The Industrial Engineering Manager.

The appraisal team must weigh the advantages and disadvantages of the alternate proposals considering for each wage plan such items as:— Costs, Operational advantages and disadvantages, Fairness of pay to employees, and Industrial Relations problems. If major changes are to be made in the wage payment system, the team would also determine the best method for obtaining employee acceptance.

The last step is to make the improvements that were accepted in the evaluation of the proposals.

The wage payment plans are revised, the organization conditioned for the changes and the improvements put into effect. The major portion of the work is technical and is the responsibility of the industrial engineer. Conditioning the organization for the changes and obtaining acceptance is the joint responsibility of industrial engineering and the operating management. Participating in the appraisal insures management recognition of their share in this responsibility.

The contribution of the objective appraisal technique does not end with the correction of the wage incentive deficiencies. There is a better understanding by the management group of the wage payment system's effect on overall profits, and the reasons why the system may fall short of its potential. Management support in the future is assured.

SELLING MANAGEMENT ON AN APPRAISAL

You may wonder how you are going to get the operating management, who are busy with production and cost problems, to participate in solving incentive problems when incentives are generally thought of as an industrial engineering responsibility. It is true that the industrial engineer is responsible for installation and maintenance but the operating management is responsible for their use. I believe the main reason for the failure of operating management to give their full support to incentives is that they sometimes view incentives as a necessary evil rather than one of their profit tools. It is up to the industrial engineer to change this attitude.

We are not going to get management interested in participating in an appraisal by just telling them that the problem is serious enough to warrant their devoting time to its solution—they have to be shown. If we carry out the data collecting and auditing steps of the appraisal and present the results to management, we should have very little trouble in arousing their interest. When you talk about reducing profit losses, you are talking their language.

REPLACING INCENTIVES WITH OTHER WAGE PAYMENT PLANS

One aspect of an objective appraisal that may be of concern to you is my frequent reference to the replacement of incentive plans with other more suitable plans.

We have grown so accustomed to working with incentives and their problems that it may be difficult for us to visualize working with any other form of wage payment. Each type of wage payment has advantages and disadvantages. For most situations, the advantages of good wage incentives outweigh the disadvantages. However, there are some industries, plants or types of work where the disadvantages of incentives outweigh the advantages, because of the nature of the work or the working conditions. Incentive plans that paid off when they were installed may not do so on the same type of work today, because conditions have changed. We must recognize these possibilities and be willing to change our form of wage payment plans if such a change will lead to higher profits and better relations with our production workers.

Obtaining employee acceptance for a change in the wage payment system may be difficult, but should not stop us from presenting a proposal. Employee acceptance to a large degree depends on the way the proposal is presented. Employees are just as capable as management in weighing advantages and disadvantages of alternate wage systems, providing they are properly informed. To obtain employee co-operation, we have to earn it by presenting the reasons for the change, backed up by the supporting facts. If the proposal is fair to the employees as a group and they are convinced that we have laid all our cards on the table and held nothing up our sleeve, they can be surprisingly understanding and co-operative.

Don't let the fear of non-acceptance by employees prevent you from making proposals for changing over to a better form of wage payment. If the proposal is not accepted, the effort is still worth while because there will be a better understanding and tolerance of the shortcomings of the existing wage system by both management and employees.

We have a choice between several different types of wage payment systems for replacing ineffective wage incentives, however, measured day work appears to be the most popular. It is a middle of the road plan combining some desirable features of both day work and wage incentives but, like all wage payment plans, it has shortcomings. Because measured day work is so often used as a replacement for unsuccessful wage incentives, we will briefly review its features.

MEASURED DAY WORK

Measured day work combines the performance measurement feature of wage incentives and the hourly rate feature of day work. The method of performance measurement and determination of the hourly rate varies with the application. In some systems, a single hourly rate and a productivity bonus is given for each type of work. In others, there are several hourly rates for each type of work, rate changes are made in accordance with employee performance. Employee performance is measured by periodic merit rating. Merit rating is based on factors such as quality of work, versatility, dependability and productivity.

Time standards are used for the measurement of productivity as in wage incentives, but more emphasis is placed on the foreman's responsibility for maintaining productivity. It is desirable to have accurate time standards, however, inaccuracies do not create the serious problems that would occur with wage incentives. Employee productivity figures are totalled for long periods between hourly or bonus rate changes, thus the effect of inaccurate standards, if they are

reasonably consistent, is averaged out. The same is true for productivity control figures.

The advantages of measured day over wage incentives are:

1. The payment method and computation of earnings is easier to understand.
2. Employees like the steady pay, the fluctuation that is the nature of wage incentives is eliminated.
3. The foreman is closer to his employees because he assumes more responsibility for maintaining productivity.
4. Time standards can be changed with very little, if any, opposition from employees.
5. Employees are not so likely to resist method changes and are inclined to co-operate because of the effect on their merit rating.
6. Time lost by both management and employees because of production standards grievances is greatly reduced. .

Measured day work has two major disadvantages when compared to wage incentives.

1. The potential production output for most types of man paced work is lower for measured day work than for wage incentives. However, there is likely to be very little, if any, difference between the two plans for machine or conveyor paced operations.

2. The faster working employees are not paid directly in proportion to their efforts. This presents more of a problem on man paced work than for machine or conveyor paced operations.

Measured day work is not the ideal wage payment system but neither are wage incentives. The biggest asset of measured day work is the promotion of better relations and co-operation between employee and employer than is possible with wage incentives. This feature has a marked effect on overall organization costs and profits and can be the deciding factor in a choice between the two wage payment systems.

SUMMARY

Good wage incentives increase production, reduce costs and pay people fairly. Poor wage incentives decrease profits and endanger employee welfare. Relatively few wage incentive systems operate at peak performance because many of the causes of the deficiencies are either overlooked, taken for granted as the nature of incentives, or considered beyond control.

The "Positive Approach to Wage Incentives" does not accept conditions as they are but finds a way to correct the defects and obtain peak performance. I have suggested the "Objective Appraisal" technique as one way to achieve this goal.

The discussion of the three test questions for good incentives has illustrated the importance of requiring each incentive plan to stand or fall on its own merits. Judging the contribution of incentives for the system as a whole without first minutely examining each unit can only lead to continued incentive misapplication, non-discovery of unknown defects and hidden incentive costs.

Wage incentives are not suited to all types of work and working conditions. When greater overall benefits can be obtained with other forms of wage payment, we should not ignore their use just because we have the incentive habit.

Many of the causes for poor wage incentive performance are outside the control of industrial engineering, therefore, it is essential that the operating management realizes the need for their assistance in eliminating these causes. The "Objective Appraisal" technique helps solve this problem. Through management participation in the appraisal, they become intimately acquainted with the causes for poor incentive performance and the adverse effect on profits, if corrective steps are not taken. This assures full support for correcting the incentive deficiencies and future maintenance of the system.

As industrial engineers, you are responsible for the proper functioning of wage incentives. You are not absolved from that responsibility because the causes of poor performance appear to be beyond your control or are unknown to you.

If you have a disturbing doubt that incentives, in your organization, are not performing at their best, may I suggest that you resolve that doubt by making the auditing steps of an objective appraisal.

If you know that your organization has serious incentive problems but have not been able to arouse management interest in correcting the defects, I suggest you make the auditing steps of an objective appraisal to determine the profit loss. If the profit loss is substantial, you should have little difficulty in appealing to management to go the whole route of an objective appraisal.

Let us follow through on our conference theme and Bridge The Gap Between Incentives And Greater Profits With An Objective Appraisal.

CRIMPER STANDARDS

by

Peter N. Carter
A. T. Kearney & Company

Coverage:

The following set of standards cover the operation of crimping a piece of cloth and a piece of leather together in a double lip molding to form an automotive door panel cover. Because there has not been an opportunity to observe the entire range of sizes and conditions which exist, these standards will apply only to the following materials:

Cloth: Either mohair, texture cloth, or broadcloth.
Length varying from 10 to 50 inches.
Width varying from 18 to 20 inches.

Leather: Normal gauge imitation leather stock used in making door panels. No specifications are available as to possible range of gauges or stiffness of material which fits this classification.
Length varying from 10 to 50 inches.
Width varying from 5 to 9 inches.

Moldings: Standard double lip moldings either single bead or 3 bead type. Cross section as shown in sketch #1.
Length varying from 8 to 48 inches.

Equipment:

Chicago Steel Brake Press — Model 254
Ram is 50" in width limiting the molding length to a maximum of 50". Dies to hold the molding are custom made to fit the molding contours. The pins which hold the cloth and leather are quickly adjusted for the proper molding length by loosening and tightening set screws. Two stock tables are used for each work place. The dimensions and locations of the brake press and stock tables are shown in sketch #2.

Method of Operation:

A stock man brings sidewall material, imitation leather and boxes of moldings to the work area and places them in the positions indicated in sketch #2. After the pieces are crimped, an inspector inspects them on the stock table and removes them to a truck.

The actual crimping operation is as follows:

1. The operator takes approximately 40 moldings from the stock box and places them on the crimper table.

2. The operator takes approximately 30 to 40 pieces of sidewall and places them on the crimper table, folding them back over the jig on the table so that the moldings are visible.

3. The cloth is crimped to the molding by placing a molding in the crimper die, inserting the edge of a piece of sidewall in the molding, holding it in place by means of the die pins, and tripping the press.

4. When all 40 pieces have been crimped the pile is turned over to bring the other edge of the molding into position for crimping. Half of the stock of crimped pieces are then removed to the stock table behind the operator.

5. The leather is crimped to the molding and cloth in the same manner as the cloth.

6. When 20 pieces have been crimpea, the completed pieces are placed on the stock table in the rear of the operator; the remaining stock of 20 pieces is then brought back to the table and crimped, then are placed on the stock table and the cycle is repeated.

Derivation of Normal Time

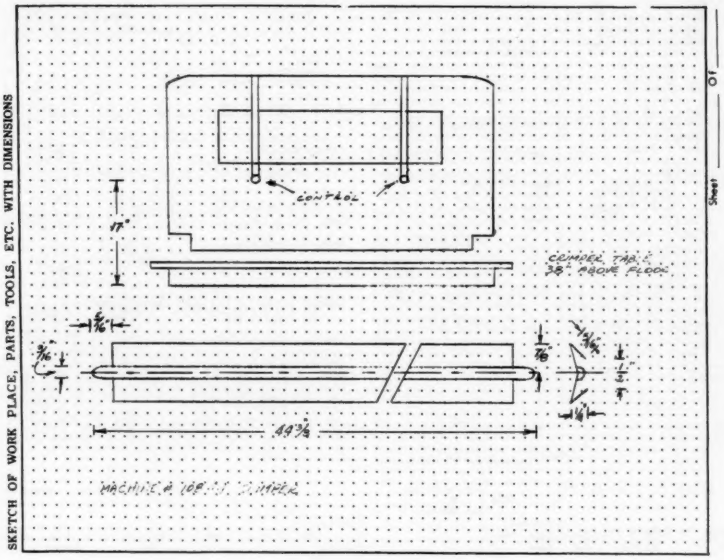
All element times have been derived from MTM studies using the basic normal times for the motions observed. The prescribed motion pattern for each element and the normal times for each are as shown in the following element breakdowns and tables.

Allowances:

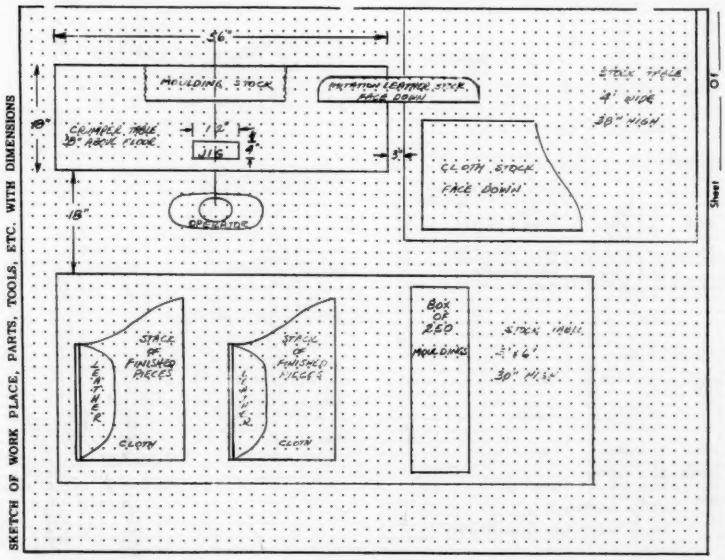
A job allowance of 15% of the basic cycle time has been allowed on all element times. This allowance was determined from time study and includes all lost time normally encountered in the operation with the exception of machine breakdowns lasting more than 6 minutes per occurrence. Specifically this allowance covers such items as:

1. Operator repairing improperly crimped cover.
2. Foreman instructions.
3. Changing crimper die for length of molding.
4. Making out time and production report.

An allowance of 10% of the basic cycle time plus the job allowance has been made to cover necessary personal and fatigue requirements.



Sketch #1



Sketch #2

TIME FORMULA I

MTM ELEMENT ANALYSIS

File B

Part Name ______ Part No. ______
Oper. Name Crimp Sidewall & Leather to Double Lip   Oper. No. ______
Operator Moulding   No. ______ Analyst ______ Date ______

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
1. Pick up and position moulding in crimper						
reach to moulding		R14B	14.4	R14B		same as L.H.
grasp		G1B	3.5	G1B		
regrasp		G2	5.6			
			5.6	G2		
move moulding to crimper		M4C	8.0	M4C		same as L.H.
position to crimper		P2SSD	25.3	P2SSD		"
press moulding to crimper		AP2	10.6	AP2		"
release mldg.		RL2	0	RL2		"
			73.0			
2. Pick up cloth and insert in moulding and on pins						
reach to cloth		R10B	11.5	R10B		same as L.H.
grasp cloth top ply		G1B	3.5	G1B		"
lift top ply		M1B	2.9	M1B		"
		D1E	4.0	D1E		disengage cloth for mohair and texture cloth only
separate & straighten cloth		SEE TABLE I				
pull cloth up from pile		M8B	10.6	M8B		
carry cloth to pin		M8C	11.8	M8B		carry cloth near pin
insert in lip		P1SD	11.2			
place on pin		P2SD	21.8			
eye travel to other pin		SEE TABLE	I			
			3.4	M1C		move to pin
			11.2	P1SD		insert in lip of mldg.
			21.8	P2SD		place on pin
push cloth down on pin		M1A	2.5	M1A		same as L.H.
release cloth		RL1	2.0	RL1		"
			114.2			broadcloth
			118.2			mohair & texture cloth
3. Press controls & crimp						
reach to controls		R18A	12.3	R18A		same as L.H.
		G5	0	G5		"
push controls		M1A	2.5	M1A		"
CRIMP TIME			66.7			
release		RL2	0	RL2		

A. T. Kearney & Company   Sheet 1 Of ______

MTM ELEMENT ANALYSIS

File B

Part Name ______ Part No. ______
Oper. Name Crimp Sidewall & Leather to Double Lip Moulding   Oper. No. ______
Operator ______ No. ______ Analyst ______ Date ______

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
4. Dispose finished piece on crimper table						
reach to ends of cloth		R18B	17.2	R18B		same as L.H.
grasp edge of cloth		G1A	2.0	G1A		
disengage from crimper		D1E	4.0	D1E		
fold cloth back		M18B	17.0	M18B		
release		RL1	2.0	RL1		
			42.2			
where moulding length is less than 17" add following allowance for straightening pile						
same as R.H.	2	R6B	17.2	R6B	2	reach to sides of finished parts - grasp mldgs.
"	2	G5	0	G5	2	
"	2	M6B	17.8	M6B	2	move to straighten
"	2	RL2	0	RL2	2	
			35.0			
						frequency 1/20 B.C.
						1/15 mohair
5. Turn cloth and moulding assemblies around						
reach to middle of moulding		TABLE	II			
grasp moulding		G1A	2.0	G1A		same as L.H.
		G2	5.6	G2		"
lift assemblies up		TABLE	II			
			7.9	R8A		to left of L.H.
		G3	5.6	G3		
to point where R.H.		R6A				
had held pile		G1A	22.3	M10B20#		turn pile 180° about vertical axis
move assemblies down		TABLE	II			
		RL1	2.0	RL1		
			45.4			
6. Remove stack of crimped cloth assemblies to stock table						
20 pieces for B.C.	15	pieces for mohair				
reach to assemblies		R6B	8.6	R6B		same as L.H.
grasp "		G1B	3.5	G1B		"
regrasp for control		G2	5.6	G2		"
move up from table		M6BM10/2	8.2	M6BM10/2#		"
turn to left of stock table			18.6	TBC1		"
lay on stock table		M12B10/2	16.4	M12B10/2#		"
release assyl.		RL1	2.0	RL1		"
reach back for body balance		R6E	8.0	R6E		"
turn back to machine			18.6	TBC1		"
			89.5			

A. T. Kearney & Company   Sheet 2 Of ______

MTM ELEMENT ANALYSIS

File B

Part Name ______ Part No. ______
Oper. Name Crimp Sidewall & Leather to Double Lip Moulding   Oper. No. ______
Operator ______ No. ______ Analyst ______ Date ______

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
7. Fold back crimped cloth stock on jig						
reach to crimped mldgs.		mR6B	5.7	mR6B		same as L.H.
	2	G5	0	G5	2	"
straighten assys.	2	M6B	17.8	M6B	2	"
	2	RL2	0	RL2	2	"
reach for assys.		R6B	8.6	R6B		"
reach back to sides of assys.		R20B	18.6	R20B		"
grasp sides		G1A	2.0	G1A		"
fold over jig		M10B	12.2	M10B		"
		RL1	2.0	RL1		
			66.9			
8. Bring crimped cloth assys. from stock table to crimper						
			15.0	W1P		walk to assy. from disposal of finished pieces
		mR6B	5.7	mR6B		reach to assy.
		G1B	3.5	G1B		
		G2	5.6	G2		get better control
		M18B10/2	20.2	M18B10/2		lift off table
			18.6	TBC1		turn to crimper
		M18B10/2	20.2	M18B10/2		move to bed of crimper
		RL1	2.0	RL1		
			90.8			
9. Pick up & position mldg. & cloth in crimper						
reach mldg. & cloth		R14B	14.4	R14B		same
grasp mldg.		G1B	3.5			
regrasp		G2	5.6			grasp mldg.
			5.6	G2		regrasp
disengage cloth (for Mohair only)		D1E	4.0	D1E		
pull out from pile		M8B	10.6	M8B		same
carry to crimper		M10C	13.5	M10C		"
position in crimper		P2SSD	25.3	P2SSD		
press mldg. down		AP2	10.6	AP2		same
release		RL2	0	RL2		"
			89.1	- Broadcloth		
			93.1	- Mohair and texture cloth		

A. T. Kearney & Company   Sheet 3 Of ______

MTM ELEMENT ANALYSIS

File B

Part Name ______ Part No. ______
Oper. Name Crimp Sidewall & Leather to Double Lip Moulding   Oper. No. ______
Operator ______ No. ______ Analyst ______ Date ______

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
10. Pick up & position leather on pins & mldg.						
			10.1	R8B		reach to leather stock
			3.5	G1B		grasp top ply
		TABLE III				move to other hand
grasp leather		G3	5.6			release leather
carry lea. towards pin		TABLE III				reach to end of leather
carry leather to pin		M5C	9.2			
insert in mldg. lip		P1SD	11.2			
place on pin		P2SD	21.8			
eye travel to other pin		TABLE III				
			3.4	M1C		carry leather to pin
			11.2	P1SD		position in mldg. lip
			21.8	P2SD		position on pin
			10.6	AP2		stretch leather and place on pin
push cloth down on pin		M1A	2.5	M1A		same
release		RL1	2.0	RL1		"
			112.9			
11. Smooth out leather in mldg.						
reach near center of lea.		TABLE IV				same
contact grasp		G5	0	G5		"
smooth out leather		TABLE IV				"
			0			
12. Press controls and crimp						
same as element #3						
13. Dispose finished piece on crimper table						
same as element #4						
14. Move finished pieces to stock table						
frequency 1/20 B.C.		1/15 Mohair				
		R20B	18.6	R20B		reach moulding middle
same as R.H.		G1A	2.0	G1A		grasp mouldings
"		G2	5.6	G2		regrasp
"		M12B25/2	18.8	M12B25/2		carry pieces to body
"			37.2	TBC2		turn to table
"		M12B25/2	18.8	M12B25/2		carry to table
"		RL1	2.0	RL1		release
"	2	R6B	17.2	R6B	2	arrange stock
"	2	G5	0	G5	2	
"	2	M6B	17.8	M6B	2	
"	2	RL2	0	RL2	2	
"		R6E	5.7	R6E		to indefinite location
			18.6	TBC1		turn back to machine
			37.2	TBC2		
			199.5			

A. T. Kearney & Company   Sheet 4 Of ______

TIME FORMULA I

MTM ELEMENT ANALYSIS File B

Part Name ______ Part No. ______
Oper. Name Crimp Sidewall & Leather to Double Lip Moulding Oper. No. ______
Operator ______ No. ______ Analyst Ing Date ______

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
15. Stock mouldings on crimper table (newspaper wrapped)						
*			18.6	TBC1		turn body to stock
*			37.2	TBC2		table
same as R.H.		MR12B	10.1	MR12B		reach for mouldings
"		G5	0	G5		
"		AP1	16.2	AP1		push on pile
"	4	G2	22.4	G2	4	get fingers into pile
"		M10B10/2#	15.1	M10B10/2#		carry mldgs. out of box
		RL1				
reach to new position		R8B	18.8	M12B10#		carry to table
		G1A	2.0			
		M10B10/2#	15.1	M10B10/2#		carry toward table
			37.2	TBC2		to table
same as R.H.		M10B10/2#	15.1	M10B10/2#		
"		G1B	17.5	G1B	5	pull paper off mldgs.
"		G2	28.0	G2	5	
"		M12B	67.0	M12B	5	
"		M8B	53.0	M8B	5	
"		RL1	10.0	RL1	5	
"		R12B	64.5	R12B	5	
						frequency 1 in 40 cycles
			44.78			

*Turn based on assumption "stock mouldings" will not necessarily occur at end of element "dispose finished pieces"

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
16. Stock mouldings on crimper table (tissue wrapped)						
* turn body 180°			18.6	TBC1		
			37.2	TBC2		
reach to mouldings		mR12B	10.1	mR12B		same as L.H.
		G5	0	G5		"
push fingers into pile		AP1	16.2	AP1		"
	4	G2	22.4	G2	4	"
move mldgs. out of box		M10B10/2	15.1	M10B10/2#		"
		RL1	18.8	M12B10#		carry mldgs.
reach for new grip		R8B				
		G1A	2.0			
		M10B10/2	15.1	M10B10/2#		carry mldgs.
			37.2	TBC2		turn body
		M12B10/2		M12B10/2#		carry to table

A. T. Kearney & Company Sheet 5 Of ______

MTM ELEMENT ANALYSIS File B

Part Name ______ Part No. ______
Oper. Name Crimp Sidewall & Leather to Double Lip Mould Oper. No. ______
Operator ______ No. ______ Analyst Ing Date ______

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
pick out tissue paper	11	RL1	22.0	RL1	11	same as L.H.
	10	R6B	86.0	R6B	10	"
	10	G1A	17.0	G1A	10	"
	10	M6B	89.0	M6B	10	"
regrasp tissue		G2	5.6	G2		
transfer to L.H.		G3	5.6	G3		
			17.0	SS12C1		
carry paper to box		mM10B	8.6			
		RL1	2.0			
		R10Em	7.6			
			17.0	SS12C1		
arrange mldgs.	3	R6B	25.8	R6B	3	same as L.H.
	3	G5	0	G5	3	"
	3	M6B	26.7	M6B	3	"
	3	RL2	0	RL2	3	"
			539.0			
						frequency 1 in 40 cycles

*Turn 180° based on assumption "stock mouldings" will not necessarily occur at end of element "dispose finished pieces"

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
17. Stock cloth on crimper table						
side step to right			17.0	SS12C1		
reach to cloth		mR14B	11.5			
		G5	0			
raise cloth		M2B10#	9.0			
regrasp		G2	5.6			
move cloth		TABLE V				
			2.0	G1A		grasp pile
			17.0	SS12C1		
move to table		TABLE V				
		RL1	2.0	RL1		same as L.H.
reach near end of pile		R14B	14.4	R14B		"
		G1A	2.0	G1A		"
fold cloth		M8B10/2	13.4	M8B10/2#		"
		RL1	2.0	RL1		"
arrange cloth	2	R6B	17.2	R6B	2	"
	2	G5	0	G5	2	"
	2	M6B	17.8	M6B	2	"
	2	RL2	0	RL2	2	"
			130.9			
						frequency 1/40 B.C.
						1/30 Mohair

A. T. Kearney & Company Sheet 6 Of ______

Table I
Element II - Pick up cloth and insert in moulding on pins

Motion 4 - Separate and straighten cloth
$M\left(\frac{L-3}{2}\right)B$ where L = length of moulding - hands are about 6" apart, Cloth is 3" longer than moulding

Motion 9 - Eye travel to second pin
$15.2 \times \frac{L}{25}$ where L = length of moulding

L	B/C Constant	Mohair Constant	$M\left(\frac{L-3}{2}\right)B$	ET	B/C Total	Mohair Total
10	114.2	118.2	6.3	6.1	126.6	130.6
12	"	"	7.4	7.3	128.9	132.9
14	"	"	8.5	8.5	131.2	135.2
16	"	"	9.3	9.7	133.2	137.2
18	"	"	10.2	10.9	135.3	139.3
20	"	"	11.1	12.2	137.5	141.5
22	"	"	11.9	13.4	139.5	143.5
24	"	"	12.5	14.6	141.3	145.3
26	"	"	13.4	15.8	143.4	147.4
28	"	"	14.0	17.0	145.2	149.2
30	"	"	14.6	18.2	147.0	151.0
32	"	"	15.2	19.5	148.9	152.9
34	"	"	15.8	20.0	150.0	154.0
36	"	"	16.4	20.0	150.6	154.6
38	"	"	17.0	20.0	151.2	155.2
40	"	"	17.6	20.0	151.8	155.8
42	"	"	18.2	20.0	152.4	156.4
44	"	"	18.8	20.0	153.0	157.0
46	"	"	19.4	20.0	153.6	157.6
48	"	"	20.0	20.0	154.2	158.2

Table II
Element V - Turn cloth and moulding assemblies around

Motion 1 - Reach to middle of moulding
$R\left(\frac{L+3}{2}-4\right)B$ L = length of moulding

Motion 4 & 6 - Lift crimped assemblies up and lay crimped assemblies down.
$2\times M\left(\frac{L+3}{2}+4\right)B\,25/2\#$ L = length of moulding

L	Constant	$R\left(\frac{L+3}{2}-4\right)B$	$2\times M\left(\frac{L+3}{2}+4\right)B\,25/2\#$	Total
10	45.4	4.7	35.6	85.7
12	"	5.8	36.9	88.1
14	"	7.1	38.2	90.7
16	"	8.2	39.5	93.1
18	"	9.0	40.9	95.3
20	"	9.7	42.2	97.3
22	"	10.5	43.5	99.4
24	"	11.2	44.9	101.5
26	"	11.9	46.2	103.5
28	"	12.6	47.5	105.5
30	"	13.1	48.9	107.4
32	"	13.8	50.2	109.4
34	"	14.5	51.5	111.4
36	"	15.3	52.8	113.5
38	"	16.1	53.2	114.7
40	"	16.8	54.5	116.7
42	"	17.6	55.8	118.8
44	"	18.3	56.2	119.9
46	"	19.0	57.5	122.9
48	"	19.7	58.8	123.9

TIME FORMULA I

Table III
Element X - Pick up and position leather on pins and in moulding lip

Motion 3 - Move leather to left hand with right hand

$M\left(\frac{L+3}{2}+L\right)A$ L = length of moulding

Motion 5 - Carry leather to pin with left hand

$M\left(\frac{L+3}{2}\right)B$ L = length of moulding

Motion 9 - Eye travel to right hand pin

ET = 15.2 X $\frac{L+3}{25}$ L = length of moulding

L	Constant	$M\left(\frac{L+3}{2}+L\right)A$	$M\left(\frac{L+3}{2}\right)B$	ET	Total
10	112.9	13.6	9.7	7.9	144.1
12	"	14.4	10.6	9.1	147.0
14	"	15.2	11.5	10.3	149.9
16	"	16.0	12.2	11.6	152.7
18	"	16.8	12.8	12.8	155.3
20	"	17.6	13.4	14.0	157.9
22	"	18.4	14.0	15.2	160.5
24	"	19.2	14.6	16.4	163.1
26	"	20.0	15.2	17.6	165.7
28	"	20.8	15.8	18.9	168.4
30	"	21.6	16.4	20.0	170.9
32	"	22.4	17.0	20.0	172.3
34	"	23.2	17.6	20.0	173.7
36	"	24.0	18.2	20.0	175.1
38	"	24.7	18.8	20.0	176.4
40	"	25.5	19.4	20.0	177.8
42	"	26.3	20.0	20.0	179.2
44	"	27.1	20.6	20.0	180.6
46	"	27.9	21.2	20.0	182.0
48	"	28.7	21.8	20.0	183.4

Table IV
Element XI - Smooth out leather in moulding

Motion 1 - Reach near center of leather

$R\left(\frac{L}{2}\right)B$ L = length of moulding

Motion 3 - Smooth out leather

$M\left(\frac{L}{2}\right)B$ L = length of moulding

L	$R\left(\frac{L}{2}\right)B$	$M\left(\frac{L}{2}\right)B$	Constant	Total
10	7.8	8.0	0	15.8
12	8.6	8.9	"	17.5
14	9.3	9.7	"	19.0
16	10.1	10.6	"	20.7
18	10.8	11.5	"	22.3
20	11.5	12.2	"	23.7
22	12.2	12.8	"	25.0
24	12.9	13.4	"	26.3
26	13.7	14.0	"	27.7
28	14.4	14.6	"	29.0
30	15.1	15.2	"	30.3
32	15.8	15.8	"	31.6
34	16.5	16.4	"	32.9
36	17.2	17.0	"	34.2
38	17.9	17.6	"	35.5
40	18.6	18.2	"	36.8
42	19.4	18.8	"	38.2
44	20.1	19.4	"	39.5
46	20.8	20.0	"	40.8
48	21.5	20.6	"	42.1

Table V
Element XVII - Stock cloth on crimper table

Motion 6 - Move cloth with left hand

Motion 9 - Move cloth to table
These moves are each half of the total move from the stock table to the crimper table

$2 \times M\left(\frac{L+3}{2}\right)B\ 25/2\ \#$ L = length of moulding

L	Constant	$2 \times M\left(\frac{L+3}{2}\right)B\ 25/2\ \#$	Total
10	130.9	28.4	159.3
12	"	30.4	161.3
14	"	32.4	163.3
16	"	34.2	165.1
18	"	35.6	166.5
20	"	36.8	167.7
22	"	38.2	169.1
24	"	39.6	170.5
26	"	40.8	171.7
28	"	42.2	173.1
30	"	43.6	174.5
32	"	44.8	175.7
34	"	46.2	177.1
36	"	47.6	178.5
38	"	48.8	179.7
40	"	50.2	181.1
42	"	51.6	182.5
44	"	52.8	183.7
46	"	54.2	185.1
48	"	55.6	186.5

Sample Calculation

D42 4 Door Custom Front Door - Broadcloth
Mouldings 34 1/2" long - newspaper wrapped

Element	Source	TMU/occ	occ/cycle	TMU/pc
I Pickup and position moulding in crimper	Constant	73.0	1	73.0
II Pick up cloth & insert in moulding & on pins	Table I	150.2	1	150.2
III Press controls & crimp	Constant	81.5	1	81.5
IV Dispose finished piece on crimper table	Constant	42.2	1	42.2
V Turn cloth and moulding assemblies around	Table II	111.9	1/40	2.8
VI Remove stack of 20 crimped cloth assemblies to stock table	Constant	89.5	1/40	2.2
VII Fold back crimped cloth on jig	Constant	66.9	1/20	3.3
VIII Bring 20 crimped cloth assemblies from stock table to crimper	Constant	90.8	1/40	2.3
IX Pick up and position moulding and cloth in crimper	Constant	89.1	1	89.1
X Pick up and position leather on pins & in moulding	Table III	174.1	1	174.1
XI Smooth out leather in moulding	Table IV	33.2	1	33.2
XII Press controls and crimp	Constant	81.5	1	81.5
XIII Dispose finished piece on crimper table	Constant	42.2	1	42.2
XIV Move finished pieces to stock table	Constant	199.5	1/20	10.0
XV Stock mouldings on crimper table(newspaper wrapped)	Constant	447.8	1/40	11.2
XVII Stock cloth on crimper table	Table V	177.4	1/40	4.4
	Total			803.2

803.2 TMU X .00001 Hrs/TMU X 1.15 X 1.10 - .01016 Hrs. per piece

TIME FORMULA I

SUMMARY OF STANDARDS
CRIMP DOUBLE LIP MOULDING TO CLOTH & LEATHER

	PIECES PER HOUR			
	BROADCLOTH		MOHAIR	
LENGTH OF MOULDING	MOULDINGS NEWSPAPER WRAPPED	MOULDINGS TISSUE WRAPPED	MOULDINGS NEWSPAPER WRAPPED	MOULDINGS TISSUE WRAPPED
10	108	108	108	108
12	107	107	107	107
14	106	106	106	106
16	105	105	105	105
18	104	104	104	104
20	103	103	103	103
22	103	102	102	102
24	102	102	102	101
26	101	101	101	101
28	100	100	100	100
30	100	99	99	99
32	99	99	99	99
34	99	98	98	98
36	98	98	98	98
38	98	97	98	97
40	97	97	97	97
42	97	97	97	96
44	97	96	97	96
46	96	96	96	96
48	96	95	96	95

STANDARD DATA

Sign Plate Engraving

by

Richard Depastina
Westinghouse Electric Corporation

For some time there has been a need to establish a standard for performing engraving operations on sign plates at the Headquarters Manufacturing Laboratory. The type of work involved at the lab consists of designing and building special equipment for our operating divisions and, as such, involves the making of a large number of sign plates having special markings.

A preliminary analysis indicated that the majority of the total time spent for engraving is for setting up each sign plate and it was decided to use MTM to establish a standard for this completely manual operation. There is also a considerable amount of similar operations, other than engraving, that a time standard of this type could be applied.

The following code has been set up to give us a numbering system for Standard Data Sheets that will be uniform for the Headquarters Division. It has been designed to identify the division, the department and the operation.

Example - HED - E5

H - Stands for Headquarters
ED - Stands for Equipment Development Department
E - Stands for Engraving
5 - Stands for the 5th element

The Standard Data attached will be applicable to micarta and brass sign plates, ranging in sizes from 1" x 4" x 1/16" tk. to 3" x 10" x 1/16" tk. inclusive. When a Standard Data Sheet is revised for any reason, it should be marked "revised" under the specific code number and one copy of the old data sheet should be retained for reference.

The variations in the range of sign plate sizes requires a separate set-up in cases when the width is increased or decreased by 1" and/or when the length of the sign plates exceed 6". This involves the method of clamping as specified by the machine manufacturer.

The variations that will exist in accordance with the clamping arrangement are as follows:

Variation #1 - Same width - length up to 6"
Variation #2 - Same width - length 6" to 10"
Variation #3 - Going from 1" width to 2" width and 4" long to 6" long
Variation #4 - Going from 1" width to 2" width and 4" long to 7" long
Variation #5 - Going from 2" width to 1" width and length change from less than 6" to 7" to 10" range.
Variation #6 - Going from 2" width to 1" width and 7" long to 4" long

All other elements described in the analysis will be considered constants.

The formula that can be used to determine the time to set up any given size of sign plate is attached. It must be pointed out, however, that the actual engraving time will vary depending on the number of markings, type of material, cutter sharpness, etc., this time is considered as process time, therefore the time must be obtained by stopwatch time study and must be added to the Standard for set-up.

All of the basic elements and their variables will remain standard as long as the same engraving machine is used for the job. However, the distance the hand travels will vary to some extent, according to the size of plate to be set up and this will require only a measurement of the distance to obtain the correct value. This will be applicable only when special size sign plates not covered by this standard are involved.

The equipment that this Standard Data applies to is the GREEN ENGRAVER - Model No. 106. The areas which involve manual adjustment are called the rear main elevator, cutter spindle, tracing stylus, depth regulator and copy

slides. Photographs of the machine are attached.

SPECIFICATIONS:

Cutter tip must be kept sharp so as to minimize the number of traces over the same line. All sign plates must be cut exactly to size before engraving and each exposed edge shall be beveled or chamfered before engraving. All finishing plates shall be stacked in sets of 25 when finished.

SAFETY:

The operator shall be furnished with eye protection during the operation. The operator must also be instructed to keep his hands free from the work plate surface during engraving.

STANDARD DATA INDEX

OPERATION - SET UP FOR ENGRAVING ALL PLATE SIZES

Standard Data Code Number	Corresponding Study Element	Element Description	TIME TMU	Time/hrs. ≠ 5% Allowance
HED-E1	A	Reposition Rear Clamp	137.4	.00144
HED-E2	B	Position Third Screw	58.5	.00062
HED-E3	C	Remove 3rd. Screw & Aside	39.6	.00042
HED-E4	D	Insert Copy Blank	74.6	.00079
HED-E5	E	Adjust Rear Elevator for Cut	50.6	.00054
HED-E6	F	Position Sign on Plate	70.9	.00075
HED-E7	G	Get Screw Driver & Position	49.1	.00051
HED-E8	H	Turn Screw Down	74.9	.00079
HED-E9	I	Move to next Screw 5"	34.5	.00037
HED-E10	J	Aside Screw Driver	19.0	.0002
HED-E11	K	Set Tracing Stylus to Depth	61.1	.00064
HED-E12	L	Adjust Cutter to Depth	55.3	.00058
HED-E13	M	Aside Stylus to Clear	12.6	.00014
HED-E14	N	Loosen Screw	76.9	.00081
HED-E15	O	Remove Finished Plate	51.5	.00055

WORK ELEMENT CLASSIFICATION

CONSTANT ELEMENTS

ELEMENT	Element Description	Time/hrs. ≠ 5% Allowance	Controlling Factors
D	Insert Copy Blank	.00079	Remains constant regardless of size of sign plate selected
E	Adjust Rear Elevator for Cut	.00054	Remains constant regardless of size of sign plate selected
F	Position Sign on Plate	.00075	Reach and Move will vary slightly but will be considered constant for the standardized layout
G	Get Screw Driver & Position	.00051	Reach and Move will vary slightly but will be considered constant for the standardized layout
H	Turn Screw Down	.00079	Same number of threads & screw size
I	Move to next screw	.00037	Fixed locating holes in both clamp and machine plate
J	Aside Screw Driver	.0002	Reach and move will vary slightly but will be considered constant for the standardized layout
K	Set Tracing Stylus to Depth	.00064	Remains constant for all sizes
L	Adjust Cutter to Depth	.00058	Remains constant for all sizes
M	Aside Stylus to Clear	.00014	Remains constant for all sizes
N	Loosen Screw	.00081	Same number of turns averaged out
O	Remove Finished Plate	.00055	Move will vary slightly but will be considered constant

VARIABLE ELEMENTS

ELEMENT	ELEMENT DESCRIPTION	Time/hrs. ≠ 5% Allowance	Variable Factors
A	Reposition Rear Clamp	.00144	Width of Sign Plate
B	Position Third Screw	.00062	Clamping Long Plates
C	Remove Third Screw and Aside	.00042	From Long Plates to Short Plates

TIME FORMULA II

METHOD OF COMPUTING VARIATIONS

Variation #1

Same width - Length up to 6"
Formula I
D + E + F + G + 2H + 2I + 2J + K + L + M + 2N + O =
.00079 + .00054 + .00075 + .00051 + .00158 + .00074 + .0004 + .00064
+ .00058 + .00014 + .00162 + .00055 = .0088 hours (Allowance included)5%

Variation #2

Same width - Length 6" to 10"
Formual II
D + E + F + G + 3H + 3I + 2J + K + L + M + 3M + O =
.00079 + .00054 + .00075 + .00051 + .00237 + .00111 + .0004 + .00064
+ .00058 + .00014 + .00243 + .00055 = .01079 hours (Allowance included)

Variation #3

Width change - Length up to 6"
Formual III
A + Formula I = .0102 hours (Allowance included)

Variation #4

Width change - length 6" to 10"
Formula IV
A + Formula II = .0119 hours (Allowance included)

Variation #5

Width change - Length change from less than 6" to 7" - 10" Range
Formula V
A + B + Formula II = .01285 hours (Allowance included)

Variation #6

Width change - Length change from more than 6" to 1" to 6" Range
Formula VI
A + C - Formula I = .0106 hours

A study of setting up for engraving a sign plate 1" x 5" x 1/16" tk. has been included as part of my evidence covering ten (10) studies.

As an example of the application of this Standard Data, when changing a sign plate from 1" x 5" x 1/16" tk. to a sign plate 2" x 8" x 1/16" tk. would be as follows:

1 - Width change from 1" to 2" = Use Element A or .00144 hrs. plus

2 - Length change from less than 6" to 8" = Use Element B or .00062 hrs. plus

3 - Formula = .01079 hrs.

Total for Sign Plate 2" x 8" x 1/16" tk. .01285 hrs.

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590
SHEET 1 OF 1

DEPT. Hdqtrs. Manufacturing | GROUP | OPER. NO. | OPERATION Set-Up for Engraving | DATE 4/18/58
PART/APPARATUS Engraving Sign Plates on Green Engraver - Model #106 | DWG. & ITEM | ANALYST R. DePastina

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E1
A. Reposition Rear Clamp						
Reach to Screw		R6A	7.0	R6A		Reach to Screw
Grasp screw		G1A	2.0	G1A		Grasp screw
Remove screw	3	MFB	6.0	MFB	3	Remove screw
	3	RL1	6.0	RL1	3	
Finger Loosen	3	RFA	6.0	RFA	3	Finger Loosen
	3	G1A	6.0	G1A	3	
Palm Screw		G2	5.6	G2		Palm Screw
Reach to Rear Clamp		R2B		R2B		Reach to Rear Clamp
Grasp Rear Clamp		G1A	2.0	G1A		Grasp Rear Clamp
Slide Clamp to 1st. Hole		M1C	3.4			
			3.4	M1C		Slide Clamp to 2nd. Hole
Align Holes		P2SE	16.2			
			16.2	P2SE		Align Holes
Release Clamp		RL1	2.0	RL1		Release Clamp
Move screw toward hole		M3B		M3B		Move Screw Toward Hole
Regrasp screw	2	G2	11.2	G2	2	Regrasp screw
Move screw to hole		M3/4C	2.0	M3/4C		Move Screw to Hole
Position screw into hole		P1SD	11.2			
			11.2	P1SD		Position screw into Hole
Start screw	3	MFB	6.0	MFB	3	Start Screw
3 turns	2	RL1	4.0	RL1	2	3 turns
	2	RFA	4.0	RFA	2	
	2	G1A	4.0	G1A	2	
Release screw		RL1	2.0	RL1		Release screw
			137.4	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590
SHEET 1 OF 1

DEPT. Hdqtrs. Manufacturing | GROUP | OPER. NO. | OPERATION Set-Up for Engraving | DATE 4/18/58
PART/APPARATUS Engraving Sign Plates on Green Engraver - Model #106 | DWG. & ITEM | ANALYST R. DePastina

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E2
B. Pick Up 3rd. Screw and Position on Clamp						
Reach to screw		R8D	11.5			
Grasp screw		G1B	3.5			
Move Screw to Left Hole		M6B	8.9			
		T45S				
		G2				
Move screw to hole		M1C	3.4			
Position into hole		P1SD	11.2			
Start Screw	3	MFB	6.0			
3 turns	2	RL1	4.0			
	2	RFA	4.0			
	2	G1A	4.0			
Release Screw		RL1	2.0			
			58.5	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590
SHEET 1 OF 1

DEPT. Hdqtrs. Manufacturing | GROUP | OPER. NO. | OPERATION Set Up for Engraving | DATE 4/18/58
PART/APPARATUS Engraving Sign Plates on Green Engraver - Model #106 | DWG. & ITEM | ANALYST R. DePastina

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E3
C. Remove Screw From Hole and Aside						
Reach to screw		R6A	7.0			
Grasp Screw		G1A	2.0			
Remove Screw	3	MFB	6.0			
3 Finger Turns	2	RL1	4.0			
	2	RFA	4.0			
	2	G1A	4.0			
Move screw aside		M8B	10.6			
		T90S				
Release Screw		RL1	2.0			
			39.6	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E4
D. Insert Copy Blank on Plate						
			16.3	R12B		Reach to Copy Blank
			7.3	SF		Select Proper Copy Blank
			3.5	G1B		Grasp
			13.4	(M12B		Move to work plate
				{G2		Regrasp copy block
			2.0	RL1		Release copy block
			8.5	R4B		Reach to copy block
			0	G5		Grasp copy block
			5.2	M2B		Move to copy holder
			10.3	M8C		Move through guides
			16.2	P2SE		Align to mark on scale
			0	RL2		Release copy block
			76.6	TMU		
Note: Repeat Element E1 for every Copy Blank Selected						

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E5
E. Adjust for Size of Cut						
			11.4	R10B		Reach to Pantograph Lever
			2.0	G1A		Grasp Pantograph Lever
			10.6	AP2		Compress Pantograph Lever
			2.0	M1A		Push lever down
			3.4	M1C		Adjust to size required
			16.2	P2SE		Align to mark on scale
			2.0	RL1		Release Lever
			50.6	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E6
F. Pick up Piece and Position on Work Plate						
			11.5	R8B		Reach to [illegible] piece
			3.5	G1B		Grasp from stack
			11.5	(M10B		Move to Plate
				{G2		Regrasp
			2.0	RL1		Release piece
Reach to piece		R10A	8.7	R8A		Reach to piece
Grasp and hold		G5	0	G5		Grasp piece
			8.0	M6A		Slide toward Centerline
			16.2	P2SE		Align to 1st. mark
			8.0	M7B		Slide piece to 2nd. mark
			16.2	P2SE		Align to 2nd. mark
Release piece		RL2	0	RL2		Release piece
			78.2	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E7
G. Get Screw Driver and Position in Slot						
			11.5	R10B		Reach to screw driver
			2.0	G1A		Grasp screw driver
			10.3	(M8C		Move screw driver to 1st. screw
				{G2		Regrasp Screw Driver
			21.1	P2SSD		Position screw driver in slot
			45.1	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver-Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E8
H. Turn Screw Down						
Reach to Screw Driver at Point		R2A	7.9			
Grasp point		(G1A)	15.0	R2A	6	}
			12.0	G1A	6	}
			17.4	M1B	6	} Turn Screw Down
			12.0	RL1	6	}
			10.6	AP2		Tighten Screw
			74.9	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E9
I. Move Screw Driver and Position on to Next Screw						
			9.2	M6A)		Move screw driver to 2nd. screw
				G2 }		Regrasp screw driver
			21.1	P2SSD		Position into slot
			30.3	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E10
J. Aside Screw Driver						
			17.0	M16B		Move screw driver aside
			2.0	RL1		Release screw driver
			19.0	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29590 — SHEET 1 OF 1

DEPT.	GROUP	OPER. NO.	OPERATION	DATE
Hdqtrs. Manufacturing			Set-Up for Engraving - 115760	4/18/58

PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 — DWG. & ITEM: — ANALYST: R. DeFortino

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E11
K. Set Tracing Stylus to Depth						
			10.1	R8B		Reach to tracing stylus
			2.0	G1A		Grasp tracing stylus
Reach to stylus		(R7A)	12.9	M10B		Move stylus to letters
Grasp and hold		(G1A)	2.0	RL1		Release stylus
			10.5	R10A		Reach back to Elevator knob
			2.0	G1A		Grasp knob
Set stylus into Copy Blank		AP2	2.0			
		P2SE	16.2			
			3.4	M1C		Adjust elevator 2°
Release stylus		RL1	2.0	RL1		Release elevator knob
			63.1	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29580

SHEET 1 OF 1

DEPT.: Hdqtrs. Manufacturing | GROUP: | OPER. NO.: | OPERATION: Set-Up for Engraving | DATE: 4/18/58
PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 | DWG. & ITEM: | ANALYST: R. [illegible]

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E12
A. Adjust Holder to Depth						
Reach to stylus at point		(R8A)	10.5	R14A		Reach to stylus at top
Grasp stylus at point		(G1A)	2.0	G1A		Grasp adjusting knob
			4.0	MFB	2	Adjust stylus
			2.0	MFB		Adjust stylus to sign plate
			16.2	[illegible]		Position to depth
			2.0	RL1		Release stylus at top
			6.1	R6A		Reach to stylus at point
			5.6	G3		Obtain hand from L.H.
			6.9	M6B		Move stylus up to clear
			55.3	TMU		
NOTE: Only put the following on 3 forms						
Number: 11058						
Process Time .0100 hours						

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29580

SHEET 1 OF 1

DEPT.: Hdqtrs. Manufacturing | GROUP: | OPER. NO.: | OPERATION: Set-Up for Engraving | DATE: 4/18/58
PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 | DWG. & ITEM: | ANALYST: R. [illegible]

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E13
B. Aside Stylus to Clear						
			10.6	M8B		Move up stylus and aside
			2.0	RL1		Release stylus
			12.6	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29580

SHEET 1 OF 1

DEPT.: Hdqtrs. Manufacturing | GROUP: | OPER. NO.: | OPERATION: Set-Up for Engraving | DATE: 4/18/58
PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 | DWG. & ITEM: | ANALYST: R. [illegible]

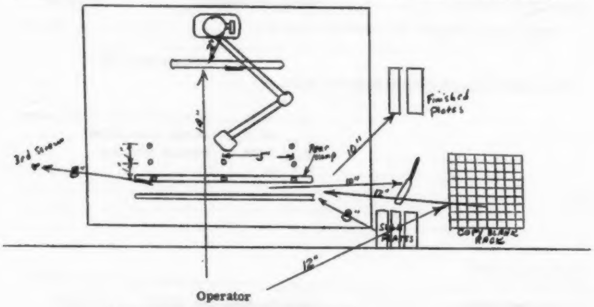
DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E14
B. Loosen Screw						
Reach to Screw Driver at Point		R8A	7.9			
Grasp point and hold		G1A	2.0			
			10.6	AP2		
			17.4	M12	6	
			15.0	M1A	6	Loosen screw with
			12.0	RL1	6	Screw Driver
			12.0	G1A	6	
			76.9	TMU		

METHODS ANALYSIS CHART
WESTINGHOUSE FORM 29580

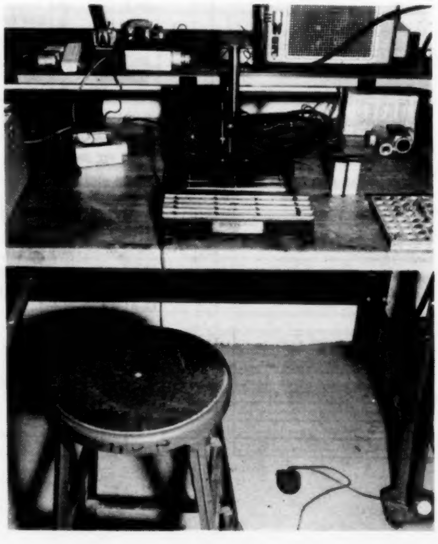
SHEET 1 OF 1

DEPT.: Hdqtrs. Manufacturing | GROUP: | OPER. NO.: | OPERATION: Set-Up for Engraving | DATE: 4/18/58
PART/APPARATUS: Engraving Sign Plates on Green Engraver - Model #106 | DWG. & ITEM: | ANALYST: R. [illegible]

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
						ANALYSIS REF. - E16
C. Remove Finished Plate						
Release screw driver at point		(RL1)	11.2	G2	2	Palm screw driver
Move hand aside		(M3B)	6.1	R6A		Reach to Mixarta Plate
			0	G5		Grasp plate
			10.6	M8B		Slide Plate out
			0	RL2		Release plate
			3.5	G13		Pick up plate
			12.2	M10B		Move plate aside
			2.0	RL1		Release on table
			51.5	TMU		



LAYOUT TO SET UP FOR ENGRAVING



STANDARD DATA

Aluminum Cleco Operation

by

Oasten J. Beard
Hill Air Force Base

PART: Any new metal skin from .020 to .032 thickness
OPERATION: Cleco old skin to new
WORK STATION Surface control
ALLOWED TIME:

Set-up
.00926 Constant per skin

Each Cleco Time
Clecos for 1st row of skin
.00333 (N) Table II Sheet 15

Each Cleco Time

Clecos for remaining rows
.00289 (N) Table IIIA and IIIB Sheet 16

Where N = Number of clecos per row

APPLICATION: This formula applies to the operation Cleco old skin to new preparatory to drilling new skin completely as performed in surface control unit under the conditions in effect as of

Formula Sheet Metal Repair Dept. #1
Date: 19 November 1958
Sheet 2 of 18 Sheets

ANALYSIS: Tools and equipment required by the operator are a standard work bench, clecos, cleco pliers, and a drill motor with correct drill.

The metal to make the new skin is brought to the work area by a material handler and placed on the work bench as shown in work place layout. It was determined after observing several cleco operations that clecos would be installed every 8 inches when getting new skin ready to drill. Operator goes to cabinet to get 1/8 clecos and returns to bench. He then gets the drill motor from the assembly bench and returns and hooks drill motor up to air hose at work bench.

Operator wow will drill and install one each cleco at a time until the first row of clecos are installed. Then the remaining rows of clecos will be installed, drilling 3 each holes and installing 3 each clecos until all clecos are installed.

PROCEDURE:

Set-up

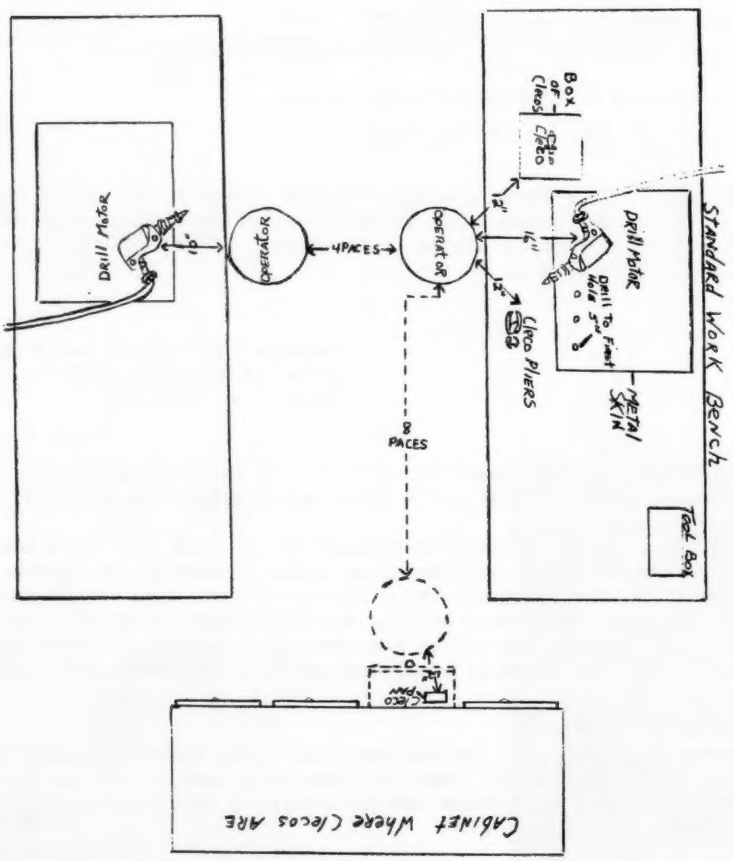
Get clecos and drill motor to bench and hook up drill motor to air hose.

Cleco time for 1st Row

Drill hole and aside motor,get clecos and pliers and install cleco.

Cleco Time for Remaining Rows of Clecos

Get drill motor, drill remaining holes, 3 each at a time, and drill motor, get clecos and cleco pliers, install clecos 3 each at a time and aside remaining clecos and pliers.



WORK MEASUREMENT THODS ANALYSIS CHART — Reference No. 1

PART: Standard Data	DATE: 19 November 1958	STUDY NO. 12	
OPERATION: Cleco old skin to new	ANALYST: O. Beard	PAGE 5 OF 18 PAGES	

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(A) To cabinet get clecos and return to bench						
			18.6	TBC1		Toward cabinet
			120.0	W6P		To cabinet
			18.6	TBC1		At cabinet
To Door handle		R6A	29.0	B		Bend tocabinet & reach
Grasp handle		G1A	2.0			Door Handle with left hand
To loosen		AP1	16.2			
Slide open		M8A	9.7			
			14.2	R12C		To right pan of clecos
			7.3	G4A		Pick up
			13.4	M12B		Move from cabinet
To close drawer		AP2	10.6			
Close drawer		M8A	9.7			
Release handle		RL 1	31.9	AB		Arise from cabinet
			18.6	TBC1		Toward work bench
			120.0	W6P		To Bench
			18.6	TBC1		At bench
				M7B		Pan to Bench
			2.0	RL1		Release

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
A	To cabinet - get clecos	460.3	.004603	15	.005293	1	.00529
	Return to bench						
						TOTAL	.00529

AMC FORM 19 MAY 56 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL) AF-WP-O-36 NOV 56 4700

SKETCHES (EQUIPMENT, TOOLS, PARTS, WORK PLACE LAYOUT, ETC)

DWG NO.	
PART DESCRIPTION	Any metal skin For any surface control
MATERIAL	.020 to .032 24 ST Alum
OPERATION	Cleco old skin to new one Ready to Drill
OPER NO.	
LOCATION	Bldg 265 Surface controls
OPERATOR NAME / NO.	
MAN WOMAN	
EQUIPMENT	Standard work bench clecos
SPECIAL TOOLS	Cleco pliers - drill motor
CONDITIONS	Normal
QUALITY REQUIREMENTS	These clecos must be installed to hold old skin in place while drilling a new one.
STUDIED BY	Oasten Beard
APPROVED BY	

WORK MEASUREMENT THODS ANALYSIS CHART — Reference No. 2

PART: Standard Data	DATE: 19 November 1958	STUDY NO. 12	
OPERATION: Cleco old skin to new	ANALYST: O. Beard	PAGE 6 OF 18 PAGES	

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(B) To assembly bench to get drill motor - Return						
			18.6	TBC1		Toward Assembly
			60.0	W4P		To Assembly
To drill motor		R10B	11.5			
Pick up		G1A	2.0			
Move near body		M12B	13.4	R8B		To Hose connection
Gain Control		G2				
			2.0	G1A		Grasp hose at connection
			16.2	AP1		Push connection to release motor
Motor from Hose		D2E	7.5	D2E		Hose from motor
			8.9	M6B		Aside Hose
			2.0	RL1		Release
			18.6	TBC1		Toward Work bench
			60.0	W4P		To Work Bench
Aside motor		M8B	10.6			
Release		RL1	2.0			

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
B	To assembly bench - get drill motor - Return	233.3	.002333	15	.002683	1	.00268
						TOTAL	.00268

AMC FORM 19 MAY 56 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL) AF-WP-O-36 NOV 56 4700

WORK MEASUREMENT THODS ANALYSIS CHART — Reference No. 3

PART: Standard Data	DATE: 19 November 1958	STUDY NO. 12	
OPERATION: Cleco old skin to new	ANALYST: O. Beard	PAGE 7 OF 18 PAGES	

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(C) Connect Air hose to drill						
			34.1	SS12C2	1	Side step to hose
Reach to drill	1	R16B	15.8	R12B	1	Reach to hose
Pick up	1	G1A	2.0	G1A	1	Pick up
Move to body	1	M14B	14.6	M10B	1	Move to body
Re-grasp	2	G2		G2	2	Re-grasp
			16.2	AP1	1	Depress spring
			3.4	M1C	1	Nipple to drill
			5.6	P1SE	1	Connect
			16.2	AP1	1	Seat
			2.0	RFR	1	Thumb & index finger
			2.0	RL1	1	Release hose

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
C	Connect Air Hose to Drill	111.9	.001119	15	.001287	1	.00129
						TOTAL	.00129

AMC FORM 19 MAY 56 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL) AF-WP-O-36 NOV 56 4700

WORK MEASUREMENT — THODS ANALYSIS CHART — ERENCE NO. 4

PART: Standard Data — DATE: 19 November 1958 — STUDY NO. 12

OPERATION: Cleco old skin to new — ANALYST: O. Beard — PAGE 8 OF 18 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(D) Drill first hole						
						To position to drill moving
			34.1	SS12C2		Hose out of way with RH
Drill to other hand		M6A	7.9	R8A		Reach to drill in left hand
			5.6	G3		Drill to R.H.
To skin		R5B	9.2	M5C		To hole to be drilled
				GE		Ready to drill
Hand on skin to hold		G5	11.2	P1SD		Drill to hole
Press down on skin		AP1	16.2	AP1		Press down on motor
			16.2	AP1		Press trigger to drill
						Drill machine time
Release skin		RL2	2.0	MFB		Drill from hole
			14.6	M14B		Aside Drill motor
			2.0	RL1		Release

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
D	Drill holes for 1st row of clecos	119.0	.001190	15	.001369	1	.00137
						TOTAL	.00137

AMC FORM 19 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMENT — THODS ANALYSIS CHART — ERENCE NO. 5

PART: Standard Data — DATE: 19 November 1958 — STUDY NO. 12

OPERATION: Cleco old skin to new — ANALYST: O. Beard — PAGE 9 OF 18 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(E) Install clecos 1st Row						
To cleco		R10B	11.5	R10B		Reach to pliers
Pick up		G1A	2.0	G1A		Gain control
Move close to pliers		M9B	12.2	M10B		Move close to body
Regrasp on way	2	GE		GE	2	Regrasp on way
Move cleco to pliers		M1C	3.4			
Position to pliers		P1NSE	10.4			
			3.6	M2A		Close pliers on cleco
Release cleco		RL1	2.0			
		R6B	16.2	AP1		Open cleco to install
			11.8	M8C		Move to hole
			11.2	P1SD		Position to hole
			4.6	M2B		Open pliers
			2.9	M1B		Move from cleco
			12.2	M10B		Aside pliers
			2.0	RL1		Release

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
E	Install clecos 1st row	106.0	.001060	15	.001219	1	.00122
						TOTAL	.00122

AMC FORM 19 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMENT — THODS ANALYSIS CHART — ERENCE NO. 6

PART: Standard Data — DATE: 19 November 1958 — STUDY NO. 12

OPERATION: Cleco old skin to new — ANALYST: O. Beard — PAGE 10 OF 18 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(F) Get drill motor						
			14.4	R14B		To drill
			2.0	G1A		Pick up
			15.8	M16B		Drill near body
				GE		Gain control to drill
			34.1	SS12C2		To position to drill 3 holes
(G) Drill holes						
To skin to hold		R6B	8.6			
Contact		G5	11.8	M8C		to hole with drill
			5.6	P1SE		drill to hole
Press down on skin		AP1	16.2	AP1		Press trigger on motor
						Drill machine time - study
			2.0	MFB		Drill from hole
Release		RL2				
(H) Aside drill motor			15.8	M16B		Aside Motor
			2.0	RL1		Release

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
F	Get drill motor	66.3	.000663	15	.000762	1/3	.00025
G	Drill remaining holes	44.2	.000442	15	.000508	1	.00051
H	Aside drill motor	17.8	.000178	15	.000205	1/3	.00007
						TOTAL	.00083

AMC FORM 19 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMENT — THODS ANALYSIS CHART — ERENCE NO. 7

PART: Standard Data — DATE: 19 November 1958 — STUDY NO. 12

OPERATION: Cleco old skin to new — ANALYST: O. Beard — PAGE 11 OF 18 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(I) get Clecos						
			34.1	SS12C2		Toward pliers & clecos
To clecos	1	R12B	12.9	R12B		To pliers
Hand to clecos	1	P1SE	5.6			
Grasp	1	G1A	2.0	G1A		Pick up
Wrap fingers around clecos	1	AP1	16.2			
Move near body clecos in hand	1	M12B	13.4	M12B		Move near body
Clecos to palm		GE		GE		
			34.1	SS12C2		Back to install clecos 3 ea
(J) Install Remaining clecos						
			5.7	M3B		Move pliers close to cleco
Cleco to pliers		M1C	3.4			
Position to pliers		P1NSE	11.2			
			3.6	M2A		Close pliers on cleco
Release cleco		RL1	16.2	AP1		open cleco by squeezing plier handle
			11.8	M8C		Move to hole
Gain control next cleco from hand		G2	11.2	P1SD		Position cleco to hole
			4.6	M2B		Open pliers
			2.9	M1B		Move back from cleco
(K) Aside remaining clecos and pliers						
Aside clecos		M9B	14.6	M14B		Aside pliers
Release		RL1	2.0	RL1		Release

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
I	Get clecos - pliers	118.3	.001183	15	.001360	1/3	.00045
J	Install remaining clecos	70.6	.000706	15	.000819	1	.00081
K	Aside remaining clecos	16.6	.000166	15	.000191	1/3	.00006
						TOTAL	.00132

AMC FORM 19 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMENT PROJECT
REPETITIVE TIME STUDY SHEET

REFERENCE NO. 8 — PAGE 12 OF 18 PAGES

STUDY NO.	OPERATION: Drill 1/8 Holes		DEPT CODE: MIUMSB
PART NAME & TYPE: New Skins			STOCK NO.
LOCATION: Bldg 265 Surface Controls		MACHINE NO.	CONTROL STATION NO.
OPERATOR'S NAME: Sage	OPERATOR'S NO.	DRAWING NO.	OBSERVER: Beard
MATERIAL: 24ST Alum .020 TO .032	WEIGHT	T.O. OR Q.C.A. NO.	DATE
START TIME	STOP TIME		ELAPSED TIME

NO.	ELEMENT DESCRIPTION	1	2	3	4	5	6	7	8	9	10	TOT / CYCLE	AVG OR SEL	LEV FAC	NOR TIME	OCC	BASE MIN
	Drill Holes in	.03	.04	.03	.04	.03	.04	.03	.03	.04	.03	.71		100			
	.020 24ST 1/8 Holes	.05	.04	.03	.03	.04	.03	.04	.05	.03	.03	20					
	Drill 1/8 Holes	.03	.04	.03	.04	.04	.04	.03	.04	.03	.04	.72		100			
	.020 24ST	.04	.04	.03	.04	.03	.04	.04	.03	.04	.03	20					
	Drill 1/8 Holes in	.04	.03	.03	.05	.03	.04	.04	.03	.04	.03	.75		100			
	.025 24ST	.05	.04	.03	.04	.03	.04	.04	.04	.03	.04	20					
	Drill 1/8 Holes in	.04	.04	.03	.03	.05	.03	.03	.04	.03	.03	.73		100			
	.025 24ST	.05	.03	.04	.03	.04	.04	.05	.03	.03	.04	20					
	Drill 1/8 Holes in	.04	.04	.03	.04	.04	.05	.04	.04	.04	.05	.84		100			
	.032 24ST	.04	.04	.04	.05	.04	.04	.05	.04	.05	.04	20					
	Drill 1/8 Holes in	.05	.04	.05	.04	.04	.04	.04	.04	.04	.05	.83		100			
	.032 24ST	.04	.04	.05	.04	.04	.05	.05	.04	.05	.04	20					
	Average of All Holes Drilled 120 Holes											4.57 / 120	.0380	100			.03808

REMARKS	A. TOTAL TIME	.03808	
	B. P R & D ALLOWANCE	15%	.04379
	C. TASK ALLOWANCE 20%		
REVIEWED BY (DATE)	D. STANDARD HOURS PER Hole Inst. Time		.0007298
	USE Per Hole Drilled		.00073

AMC FORM 18 OCT 54 142AF — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. — REP. PRESS. MAN., O FEB. 13, 57 257,000

W. MEASUREMENT OPERATION SUMMARY

PART: Standard Data	DATE: 19 November 1958	STUDY NR: 12
OPERATION: Cleco old skins to new	ANALYST: O. Beard	PAGE 13 OF 18 PAGES

NR	ELEMENT DESCRIPTION	ANALYSIS CHART REF	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
A	To cabinet - get clecos Return to bench	1	460.3	.004603	15	.005293	1	.00529
B	To assembly bench - get drill motor - return	2	233.3	.002333	15	.002683	1	.00268
C	Connect air hose to drill motor	3	111.9	.001119	15	.001287	1	.00129
D	Drill first hole	4	119.0	.001190	15	.001369	1	.00137
E	Install clecos for 1st row	5	106.0	.001060	15	.001219	1	.00122
F	Get drill motor for drilling Remaining holes	6	66.3	.000663	15	.000762	1/3	.00025
G	Drill remaining holes	6	44.2	.000442	15	.000508	1	.00051
H	Aside drill motor	6	17.8	.000178	15	.000205	1/3	.00007
I	Get several clecos and pliers	7	118.3	.001183	15	.001360	1/3	.00045
J	Install remaining clecos	7	70.6	.000706	15	.000819	1	.00081
K	Aside clecos and pliers	7	16.6	.000166	15	.000191	1/3	.00006
L	Machine time for drilling holes 8							.00074

TOTAL TIME ALLOWED PER —

AMC FORM 19 MAY 55 142AM — (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL) — AF-WP-O-2 OCT 56 35,000

Formula Sheet Metal Repair Dept #1
Date: 19 November 1958
REFERENCE NO._____ DATE________ ANALYST O. J. Beard Sheet 14 of 18 Sheets

ELEMENT DESCRIPTION: Install clecos when drilling a new skin, using an old skin as a template. A cleco will be installed every 8 inches. This is done so the new skin will be drilled the same as the one removed and align up with the assembly that it is for.

This table will show the number of rows of clecos used and the number of clecos per row.

VARIABLES: The width of the skins will determine the rows of clecos needed. The number of clecos per row will be determined by the length of the skin.

TABLE I

1. Length of skin measured in feet
2. Number of clecos needed per row
3. Width of skins measured in feet
4. Red is the number of rows needed depending on size

		1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft
1		1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft
2		2	3	5	6	7	9	10	12	13	15	16	18
WIDTH OF SKINS IN FEET	1 Ft	2	2	2	2	2	2	2	2	2	2	2	2
	1½ Ft		2	2	2	2	2	2	2	2	2	2	2
	2 Ft		3	3	3	3	3	3	3	3	3	3	3
	2½ Ft			4	4	4	4	4	4	4	4	4	4
	3 Ft			4	4	4	4	4	4	4	4	4	4
	3½ Ft				5	5	5	5	5	5	5	5	5
3	4 Ft				6	6	6	6	6	6	6	6	6

Formula Sheet Metal Repair Dept #1
Date: 19 November 1958
REFERENCE NO._____ DATE________ ANALYST O. J. Beard Sheet 15 of 18 Sheets

ELEMENT DESCRIPTION: Time to install first row of clecos preparatory to drilling a new skin using old skin as a template.

ELEMENT FORMULA: D + E + L = .00137 + .00122 + .00074 = .00333 Hour (Number of clecos per row) = Time to install first row of clecos.

VARIABLES: Length of skin

TIME: Standard Hours per Row

TABLE II

1. Length of skins measured in feet
2. Number of clecos needed per row
3. Time for first row of clecos per skin

1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft
2	3	5	6	7	9	10	12	13	15	16	18
.00666	.00999	.01665	.01998	.02331	.02997	.03330	.03996	.04329	.04995	.05328	.05994

TIME FORMULA III

REFERENCE NO._____DATE_______ANALYST O. Beard Sheet 17 of 18 Sheets

ELEMENT DESCRIPTION: Total time to cleco old skin to new ready to drill new skin completely.

Table IV will show the total time required to cleco old skin to new as taken from Tables II and III A or III B depending on the number of rows needed

VARIABLES: The width of skin will determine how many rows will be needed as shown in Talbe I. The length will determine how many clecos per row are needed as shown in Table I.

TIME: Standard hours per skin.

TABLE IV

WIDTH OF SKIN IN FEET	LENGTH OF SKIN IN FEET											
	1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft
1 Ft	.01244	.01866	.03110	.03732	.04354	.05598	.06220	.07464	.08086	.09330	.09952	.11196
1½ Ft		.01866	.03110	.03732	.04354	.05598	.06220	.07464	.08086	.09330	.09952	.11196
2 Ft		.02733	.04555	.05202	.06377	.07199	.09110	.10932	.11843	.13665	.14576	.16398
2½ Ft			.06000	.07100	.08400	.10800	.12000	.14000	.15600	.18000	.19200	.21600
3 Ft			.06000	.07100	.08400	.10800	.12000	.14000	.15600	.18000	.19200	.21600
3½ Ft				.08934	.10423	.13401	.14890	.17868	.19357	.22335	.23824	.26802
4 Ft				.10668	.12446	.16002	.17780	.21336	.23114	.26670	.28448	.32004

REFERENCE NO._____DATE_______ANALYST O. J. Beard Sheet 16 of 18 Sheets

ELEMENT DESCRIPTION: Install remaining clecos after the first row. In each row holes will be drilled three at a time and then three clecos installed. This process will be used until all the remaining clecos have been installed.

ELEMENT FORMULA: F + G + H + I + J + K + L = .00025 + .00051 + .00007 + .00045 + .00081 + .00006 + .00074 = .00289 Hour (Number of clecos per row) = Time to install remaining clecos per row.

VARIABLES: Number of clecos used per row depends on the length of skin. The number of rows used per skin will be taken from Table I.

TIME: Standard Hours per row.

TABLE III A

1. Length of skins measured in feet.
2. Number of clecos per row.
3. Time per row after first row of clecos

1	1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft
2	2	3	5	6	7	9	10	12	13	15	16	18
3	.00578	.00867	.01445	.01734	.02023	.02601	.02890	.03468	.03757	.04335	.04624	.05202

TABLE III B Time for Additional Rows

ROWS												
2	.01156	.01734	.02890	.03468	.04046	.04202	.05780	.06936	.07514	.08670	.09248	.10404
3	.01734	.02601	.04335	.05102	.06069	.07803	.08670	.10404	.11271	.13005	.13872	.15606
4	.02312	.03468	.05780	.06936	.08092	.10404	.11560	.13872	.15028	.17340	.18496	.20808
5	.02890	.04335	.07225	.08670	.10115	.13005	.14450	.17340	.1[illegible]785	.21675	.23120	.26010

SYNTHESES:

A + B + C = .00529 + .00268 + .00129 = .00926 Hour = constant per skin.

D + E + L = .00137 + .00122 + .00074 = .00333 Hour (Number of clecos per row) = Time to install clecos in 1st row of a skin.

F + G + H + I + J + K + L = .00025 + .00051 + .00007 + .00045 + .00081 + .00006 + .00074 = .00289 Hour (Number of clecos per row) (Number of rows) = Time to install remaining clecos

Table I. The amount of clecos needed per row depending on the length of the skin and the number of rows of clecos needed depending on the width of the skin.

Table II. The time to install the first row of clecos depending on the length of the skin.

Table IIIA. The time per row for each additional row after the first row.

Table IIIB. The time for all additional rows after first row of clecos by multiplying the number of rows needed depending on the width times item three in Table IIIA depending on the length.

Table IV. The time to cleco an old skin to new metal ready to drill new skin complete. It was determined by adding the appropriate time depending on the length from Table II, and depending on the number of rows needed taken from Table IIIA or IIIB and add together will give the time for a given skin of a given size.

APPLICATION I

Reader interest suggests we publish MTM analyses from various industrial operations. The Journal will select analyses from Association files for this and future issues.

CLICKOUT SIDE FACING
(Shoe manufacturing)

by

Peter N. Carter
A. T. Kearney & Company

MTM ELEMENT ANALYSIS SUMMARY File A5

Part Name S27 Front Back Right Side Facing — Part No. N1713
Oper. Name Clickout Side Facing — Oper. No. None
Machine United Shoe Machinery Co., Clickout Machine — Mach. No. Tag #14

Department 10 Analyst Carter Date 9/52 Approved ____ Date ____
Material Broadcloth

Tools Steel Rule Die Approximately 1" High

Material Handling Stock man brings material to clickout stock table, stock man removes finished stacks from stock table

Quality Operator must cut complete piece; because of the nature of the cutting stencil there is often very little allowance between die and piece to be cut.
Safety No special safety devices

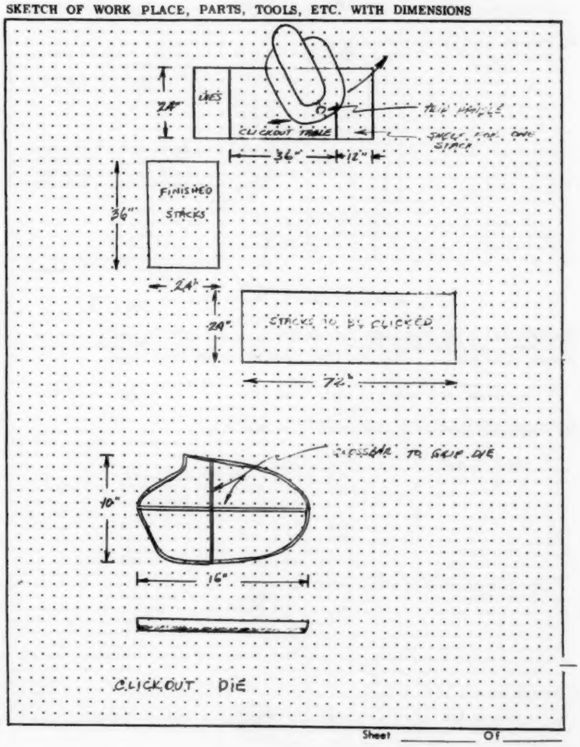
Remarks A stack of cloth is a block cut to rough size on cutting table. This stack usually 60 pieces high must be broken down into approximately 5 piles to fit under clickout machine arm.

No.	ELEMENT DESCRIPTION	Time TMU	Occurrence Per Cycle	Total Per Cycle
1.	Take stack from stock table and place on press table	110.1	1	110.1
2.	Spread stack (1st pile)	60.5	1	60.5
2A.	Spread stack (subsequent piles)	71.3	4	285.2
3.	Get die from left side of press table and position on a pile	69.4	1	69.4
4.	Reach to machine arm, move arm over die, trip machine	82.6	5	413.0
5.	Remove die from cut piece and move die to side of machine	54.5	1	54.5
5A.	Remove die from cut pile and position on next pile	76.4	4	305.6
6.	Remove scrap	75.4	5	377.0
7.	Group piles on press into stack and move stack to stock table	358.8	1	358.8

Total TMU Per Cycle		2034.1
Allowances	10 %	203.4
Allowed Hours Per Stack		.022375
Pieces Per Hour		44.7

Sheet 1 Of 5

SKETCH OF WORK PLACE, PARTS, TOOLS, ETC. WITH DIMENSIONS



Sheet ____ Of ____

APPLICATION I

MTM ELEMENT ANALYSIS

File: A5

Part Name: S27 Front Back Right Side Facing — Part No.: N1713
Oper. Name: Clickout Side Facing — Oper. No.: None
Operator: Pete Zemis — No.: 1008 — Analyst: P. Carter — Date: 9/52

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
1. Take Stack from Stock Table & Place on Press Table Right Side						
same as R.H.		R18B	17.2	R18B		to stack
"		G1B	3.5	G1B		grasp stack
"	2	G2	11.2	G2	2	
			13.4	M12B		to body
			37.2	TBC2		to machine
			17.0	SS12C1		to rt. side of press
"			8.6	M10BM		place stack on extension
"			2.0	RL1		
			110.1			
2. Spread Stack (1st Pile)						
		R4B	6.4	R4B		reach to top of stack
			0	G5		hand rests on top &
			7.3	R3C		fingers reach & grasp approximately 12 or 14
			5.6	P1SE		pieces
			0	G5		
			2.9	M1B		
			5.6	G2		
			6.9	M4B		move stack up in air
		G3	5.6	G3		& transfer to left hand,
		M20B	18.2	R6B G1A		right hand reaches to other end of pile & both hands move piece to table
		RL1	2.0	RL1		
			60.5			
2A. Spread Stack (Subsequent Piles)						
Reach to area of Stack		R10E	17.2	R18B		reach to top of stack
			0	G5		hand rests on top &
			7.3	R3C		fingers reach & grasp approximately 12 or 14
			5.6	P1SE		pieces
			0	G5		
			2.9	M1B		
			5.6	G2		
			6.9	M4B		move stack up in air &
		G3	5.6	G3		transfer to left hand rt.
		M20B	18.2	R6B G1A		hand reaches to other end of pile & both hands move piece to table
		RL1	2.0	RL1		
			71.3			

Sheet 2 Of 5

MTM ELEMENT ANALYSIS

File: A5

Part Name: S27 Front Back Right Side Facing — Part No.: N1713
Oper. Name: Clickout Side Facing — Oper. No.: None
Operator: Pete Zemis — No.: 1008 — Analyst: P. Carter — Date: 9/52

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
3. Get Die From Left Side of Press Table & Position on Pile						
reach to left side of press table		R20B	18.6	R12B		to left to grasp die
grasp die		G1A	2.0			
die to pile on press table		M20C	22.1	G1A M10C		
position one end of odd shaped die		P1NSE	10.4			
			5.2	M2C		move other end into
			9.1	P1SSE		position
		RL1	2.0	RL1		
			69.4			
4. Reach to Machine Arm, Move it Over Piece, Trip Machine						
			13.1	R20A		to handle on Mach. arm
			2.0	G1A		
			29.0	M28C		move arm over die
			5.6	P1SE		
			8.1	M6A		trip handle
			10.6	AP2		
			12.2	M10B		swing arm away
			2.0	RL1		
			82.6			
5. Remove Die From Cut Piece						
		R6B	12.9	R12B		
same as R.H.		G1A	2.0	G1A		cross bar on die
"		M2B	4.6	M2B		push cloth down with fingers
"		AP1	16.2	AP1		pull die off pile
"		D1E	4.0	D1E		
"	m	M16B	12.8	mM16B		move die to side of press
"		RL1	2.0	RL1		
			54.5			

Sheet 3 Of 5

MTM ELEMENT ANALYSIS

File: A5

Part Name: S27 Front Back Right Side Facing — Part No.: N1713
Oper. Name: Clickout Side Facing — Oper. No.: None
Operator: Pete Zemis — No.: 1008 — Analyst: P. Carter — Date: 9/52

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
5A. Remove Die From Cut Pile & Position on Next Pile						
Same as R.H.		R6B	12.9	R12B		
"		G1A	2.0	G1A		cross bar on die
"		M2B	4.6	M2B		push cloth down with fingers
"		AP1	16.2	AP1		pull die off pile
"		D1E	4.0	D1E		
		mM10C	10.0	mM10C		die to next pile
position one end of odd shaped die		P1NSE	10.4			
			5.2	M2C		
			9.1	P1SSE		
		RL1	2.0	RL1		
			76.4			
6. Remove Scrap						
same as R.H.		R16B	15.8	R16B		back to piece
grasp edge of scrap material		G1B	3.5	G5		
		G2	5.6			
move scrap up in air		M10B	12.2			
			0	RL2		
			6.1	R4A		to scrap in L.H.
		G3	5.6	G3		
to die cut piece		R4B	6.4			
		G5	0			
			18.2	M20B		move scrap over to
			2.0	RL1		scrap truck and release
			75.4			

Sheet 4 Of 5

MTM ELEMENT ANALYSIS

File: A5

Part Name: S27 Front Back Right Side Facing — Part No.: N1713
Oper. Name: Clickout Side Facing — Oper. No.: None
Operator: Pete Zemis — No.: 1008 — Analyst: P. Carter — Date: 9/52

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
7. Group Piles on Press Into Stack & Move Stack to Stock Table						
to pile from scrap		R8B	10.1	R8B		same as L.H.
	5	G5	0	G5	5	"
move edge up	5	M1B	14.5	M1B	5	"
regrasp pile	5	G2	28.0	G2	5	"
move pile to next pile	4	M8C	47.2	M8C	4	
position one pile end	4	P1NSD	64.0			
			58.8	P1SSD	4	position other pile end
	4	RL1	8.0	RL1	4	
to bottom of pile	4	R4B	25.6	R4B	4	same as L.H.
stack up in air & down against table to even edge		M18A	17.6	M18A		"
			18.6	TBC1		to stock table
		M10B	12.2	M10B		to table
		RL1	2.0	RL1		
			37.2	TBC2		
			15.0	W1P		to table containing stacks to be cut
			358.8			

Sheet 5 Of 5

APPLICATION II

SERGE RIGHT AND LEFT SIDES OF CARPET
(Automotive carpet)

by

Peter N. Carter
A. T. Kearney & Company

MTM ELEMENT ANALYSIS SUMMARY File A1

Part Name P26-2 P27-2 Plymouth Front Floor Carpet Part No. 1876732
Oper. Name Serge right and left sides of carpet Oper. No. P31
Machine 81-60 Singer Serger Mach. No. 2705
Needle Speed 3000 RPM 9 stitches per inch
Department 12 Analyst Carter Date 9/53 Approved Date
Material Automotive quality tufted carpet bound with cotton serging yarn
Tools Scissors

Material Handling Stock man brings work to operator folded as required and removes finished pieces from in front of operator

Quality Binding must catch carpet along entire sew line, thread ends must be removed

Safety No safety devices other than standard singer parts

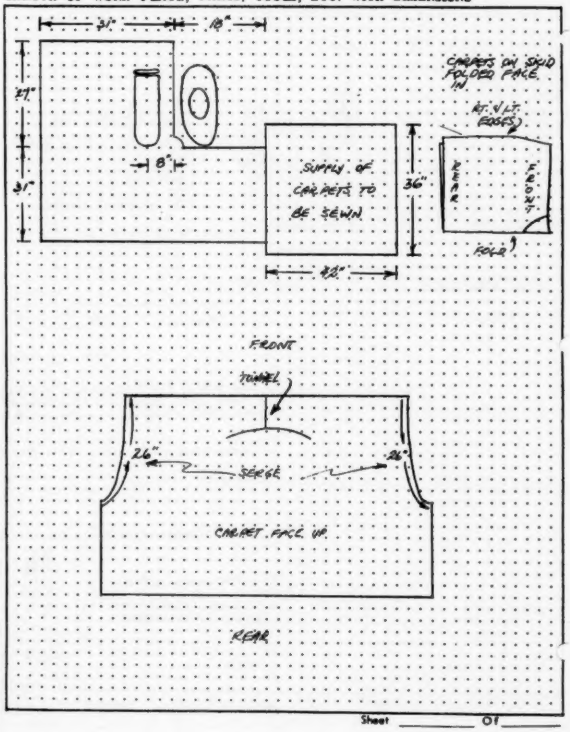
Remarks Long reach & move to get carpet is net result of body & shoulder assist

No.	ELEMENT DESCRIPTION	Time TMU	Occurrence Per Cycle	Total Per Cycle
1.	Reach into stock bin, get carpet, bring to work area and arrange for sewing	156.1	1	156.1
2.	Move sewing machine thread forward, grasp carpet at cut in middle of left side, position cutout to foot, tack	111.4	1	111.4
3.	Sew 4" past cutout	31.4	1	31.4
4.	Clip thread at beginning of sew, reposition hands	93.8	1	93.8
5.	Sew to end of side	123.4	1	123.4
6.	Reposition carpet to bring right front corner of carpet to foot face up, position right corner to left corner to machine foot	123.2	1	123.2
7.	Sew 4"	31.4	1	31.4
8.	Clip threads between right and left ends	147.3	1	147.3
9.	Sew to end of right side	160.6	1	160.6
10.	Clip thread at end of right side, push carpet forward	112.3	1	112.3
	TOTAL BASIC CYCLE			1090.9
	30% Machine Incentive			104.0
	Thread change, thread break, rip & resew .375 TMU/inch x 48"			18.0

Total TMU Per Cycle		1212.9
Allowances	5.5 %	66.7
Allowed Hours Per Piece		.0128
Pieces Per Hour		78

Sheet ____ Of ____

SKETCH OF WORK PLACE, PARTS, TOOLS, ETC. WITH DIMENSIONS



Sheet ____ Of ____

APPLICATION II

MTM ELEMENT ANALYSIS — File A1

Part Name P26-2, P27-2 Plymouth Front Floor Carpet — Part No. 1876732
Oper. Name Serge Right and Left Side of Carpet — Oper. No. P31
Operator Mary Brenson — No. 1032 — Analyst P.Carter — Date 9/53

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
1. Reach Into Stock Bin, Get Carpet, Bring to Work Area and Arrange.						
From dispose down onto truck		R40B	32.8			Carpet is folded face
behind operator						in with its left edges
edge of carpet near						toward operator - right
corner closest to						front edge of carpet to
operator		G5	0			rear of pile - left side
Raise		M2B	4.6			of carpet under and face
	2	G2	11.2			up - right side of carpet
						on top face down.
Out of bin and up onto		M40B12	37.5			
table		RL1	2.0			
To right edge of carpet		R8B	10.1			
near center		G1B	3.5			
Fold right edge back to						
expose left edge		M22B	19.4	R16B		To crease of fold being
				G5		made by left hand.
			6.9	M4B		Fold crease.
		RL1	2.0	RL2		
Same as right hand		R18B	17.2	R18B		To left edge of carpet.
" " " "		G5	0	G5		
" " " "		M6B	8.9	M6B		Edge of carpet to area
						of machine foot.
			156.1			
2. Move Sewing Machine Thread Forward, Grasp Carpet at Cut in Middle of Left Side, Position Cutout to Foot, Tack.						
Carpet		RL2	0			
To thread laying on table		R6B	8.6			
		G5	0			
Roll thread under finger		M1B	2.9			
Thread to control		G2	5.6			
Thread in front of foot		M4B	6.9			
		RL1	2.0	RL2		
To carpet in front of cut		R4B	6.4	R3B		To carpet behind cut.
		G5	0	G5		
		M4C	8.0	M4C		Slide under machine foot
				~~FM~~		Raise foot
			16.2	P2SE		Carpet to foot
			8.5	FM		Lower foot
			7.1	LM6		Move foot to treadle
			34.0	FM	4	Walk needle to corner
Pivot carpet to align for						
straight side		M2C	5.2			
			111.4			
3. Sew 4" past cutout			31.4	SEW	4"	

A. T. Kearney & Company — Sheet ___ Of ___

MTM ELEMENT ANALYSIS — File A1

Part Name P26-2, P27-2 Plymouth Front Floor Carpet — Part No. 1876732
Oper. Name Serge Right and Left Side of Carpet — Oper. No. P31
Operator Mary Brenson — No. 1032 — Analyst P.Carter — Date 9/53

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
4. Clip Thread at Beginning of Sew.						
		RL1	2.0	RL1		
To thread at beginning of		R8B	12.9	R12B		To scissors by machine
sew		G1A	3.5	G1B		base.
		G2	20.6	M24B		Scissors to thread.
			3.4	M1C		Get scissors near carpet.
			2.5	M1A		Clip thread.
Dispose thread and reach		M8Bm	20.6	M24B		Dispose scissors
back to carpet		RL1	2.0	RL1		
		mR8B				
		G5	17.2	R18B		To middle of edge of
						carpet
			3.5	G1B		Carpet
			5.6	G2		
			93.8			
5. Sew to end of side			123.4			Sew 20"
			123.4			
6. Reposition Carpet to Bring Right Front Corner of Carpet to Foot Face Up, Position rt.Corner to Left Corner to Machine Foot.						
		RL1	2.0	RL1		
To right front edge of						
carpet that had been		R10B	11.5	~~R~~		
folded out of way		G1B	3.5	R16B		To edge of center tunnel
		G2	5.6	G1A		in center of leading
						edge of carpet.
Right frong edge up in air		M24Bm	18.4			
Swing right front edge ar						
around toward foot		mM28B	21.2	M12B		Move edge to tunnel up
						in air to assist
						getting right edge
		RL1	2.0	RL1		to foot
		R3B	18.6	R20B		Both hands reach to
		G5	0	G5		right side of carpet
Same as right hand		M2B	13.4	M12B		Move right side toward
						foot.
Get fingers out of way						
of machine foot		G2	5.6			
		M2C	5.2			
Right edge to left edge		P2SE	16.2			
			123.2			

A. T. Kearney & Company — Sheet ___ Of ___

MTM ELEMENT ANALYSIS — File A1

Part Name P26-2, P27-2 Plymouth Front Floor Carpet — Part No. 1876732
Oper. Name Serge Right and Left Side of Carpet — Oper. No. P31
Operator Mary Brenson — No. 1032 — Analyst P.Carter — Date 9/53

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
7. Sew 4"			31.4			
			31.4			
8. Clip Threads Between Rt. and Lt. Ends						
		RL2	0	RL2		
		R4B	12.9	R12B		To scissors
To thread area, grasp		G1B	3.5	G1B		
carpet at join of rt. & lt.		M3B	20.6	M24B		Scissors around in
ends and raise to facili-				GX		front of foot
tate clipping thread						
			3.4	M1C		
		RL1	2.5	M1A		Clip thread
Back to area of fold in		R22E	20.6	M24B		Dispose scissors
carpet			2.0	RL1		
			18.6	R20B		To rt.edge which is off
			2.0	G1A		table surface because
Under folded carpet edge		R14B	14.4			of fold in carpet
		G1A	2.0			
		G2	5.6			
Edge back to unfold carpet		M22B	19.4	M6B		Edge up in air
(fold had been held by join		RL1	2.0			
of rt. & lt. ends)		R16B	15.8	R8B		To edge of carpet
To edge of carpet near cut		G1A	2.0	G1A		forward of cut
			147.3			
9. Sew to end of rt. side			117.7	Sew 19"		Almost to end
			42.9	Sew 3"		½ speed around corner
			160.6			
10. Clip thread at end of rt. side, push carpet forward						
		RL2	0	RL2		
To thread		R4B	12.9	R12B		To scissors
		G1B	3.5	G1B		
Thread up in air		M3B	20.6	M24B		Around in front of foot
				~~GX~~		
			3.4	M1C		
			2.5	M1A		Clip thread
		RL1	2.0			
Back toward rear edge		R12B	12.9			
		G1A	2.0			
Fold edge forward		M22B	19.4	M24B		Dispose scissors
		RL1	2.0	RL1		
To surface of carpet		R7B	9.3			
		G5	0			
Push forward		M26B	21.8			
		RL2	0			
			112.3			

A. T. Kearney & Company — Sheet ___ Of ___

APPLICATION III

JOIN FLEXLINE SKIRT TO BOTTOM OF FRONT CUSHION
(Automotive fabric)

by

Peter N. Carter
A. T. Kearney & Company

MTM ELEMENT ANALYSIS SUMMARY File A2

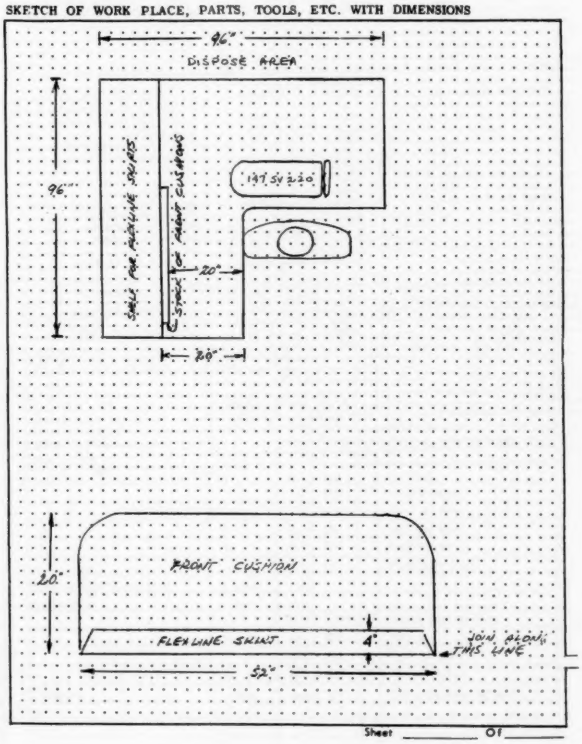
Part Name S27 4 Door Front Cushion Part No. 1876776
Oper. Name Join flex line skirt to bottom of front cush Oper. No. S16
Machine 147 SV 220 SINGLE NEEDLE 2700 Revolutions Per Minute 6 Stitches per inch Mach. No. Tag # 375
Department 16 Analyst Carter Date 9/52 Approved ______ Date ______
Material Broadcloth cushion cut to size to be joined to flex line skirt
Tools Scissors
Material Handling Stockman keeps operator supplied with cushions and skirts - Inspector removes finished parts from bin in front of machine and stacks and inspects parts
Quality Operator cannot force part and lengthen stitches per inch nor can there be skipped stitches. Corners of skirt & cushion must be within ¼" of each other
Safety No special devices
Remarks

No.	ELEMENT DESCRIPTION	Time TMU	Occurrence Per Cycle	Total Per Cycle
1.	Pick up front cushion and move to area of machine foot	93.9	1	93.9
2.	Position flex skirt on cushion, position to foot, back, reposition hands	183.9	1	183.9
3.	Sew to end 50"	183.3	1	183.3
4.	Clip and push forward	66.2	1	66.2
	TOTAL BASIC CYCLE			527.3
	30% Machine Incentive			55.0
	Thread change, thread break, rip and resew .375 T.M.U. x 52"			19.5

Total TMU Per Cycle		601.8
Allowances	5.5 %	33.1
Allowed Hours Per Piece		.006349
Pieces Per Hour		157

Sheet 1 Of 3

SKETCH OF WORK PLACE, PARTS, TOOLS, ETC. WITH DIMENSIONS



Sheet ______ Of ______

APPLICATION III

MTM ELEMENT ANALYSIS

File: A2

Part Name: S27 4 Door Front Cushion — Part No. 1876776
Oper. Name: Join flex line skirt to bottom of front cush — Oper. No. S16
Operator: Josephine Orr — No. 1207 — Analyst: Carter — Date: 9/52

DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
1. Pick up front cushion & move to area of machine foot						
from dispose to pile of		R22B	20.1	R12E		Toward pile
cushions top of pile		G5	0			
		M2B	4.6			
Get top piece		G2	5.6			
edge of cushion to R.H.		M6A	8.1	R6A		
		G3	5.6	G3		
back along edge		R16B	15.8			
		G1A	2.0			
same as R.H.		M14B	14.6	M14B		cushion over near mach-
		RL1	2.0	RL1		ine
"		R6B	8.6	R6B		to surface of cushion
"		G5	0	G5		
"		M4B	6.9	M4B		move hands in opposite
"		RL2	0	RL2		directions to smooth
			93.9			part
2. Position flex skirt on cushion, position to foot, back, reposition hands						
same as R.H.		R24B	21.5	R24B		to stack of flex skirts
"		G5	0	G5		on shelf to operator's lt
"		M2B	4.6	M2B		start piece off pile
"		G1A	2.0	G1A		and grasp
"		M26B	21.8	M26B		skirt onto cushion
		G2	-	G2		
		RL1	2.0			
to front end of skirt		R18B	17.2	G2		
		G1B	3.5			
same as R.H.		M4C	8.0	M4C		move corner of skirt to corner of cushion
"		P2SSE	19.7	P2SSE		position corners
			8.0	M4C		to machine foot
				1M		raise foot
"		P2SSE	19.7	P2SSE		corners to foot
			7.1	1M		lower foot
			17.0	FM	2	tack
		RL1	2.0	RL1		
back along flex skirt edge		R10B	11.5	R8E		back along edge
edge of skirt		G1B	3.5			
up in air		M3B	5.7	R3B		to skirt
		G2	3.5	G1B		
			5.6	G2		
			183.9			
3. Sew 50"			183.3			

Sheet 2 Of 3

MTM ELEMENT ANALYSIS

File: A2

Part Name: S27 4 Door Front Cushion — Part No. 1876776
Oper. Name: Join flex line skirt to bottom of front cush — Oper. No. S16
Operator: Josephine Orr — No. 1207 — Analyst: Carter — Date: 9/52

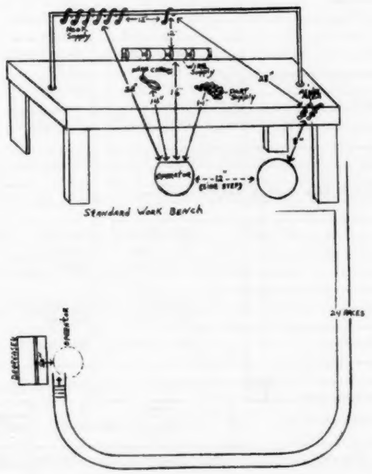
DESCRIPTION - LEFT HAND	F	MOTION	TMU	MOTION	F	DESCRIPTION - RIGHT HAND
4. Clip & push forward						
				RL1		
				R10E		limited [illegible] during sew
			8.6	R10B		to scissors
			3.5	G1B		
at end of sew to raise		G2	19.4	M22B		scissors in front of
thread				G2		machine foot
			3.4	M1C		
			2.5	M1A		
pull part back		M10B	12.2			
push forward		M14B	14.6	M22B		
		RL1	2.0	RL1		dispose scissors
			66.2			

Sheet 3 Of 3

PREPARE PARTS FOR PLATING

by

Oasten J. Beard
Hill Air Force Base



PART: Spacer for Brake Disc
OPERATION: Part Ready for Plating
WORK STATION: Plating Shop
ALLOWED TIME: Standard Hours per Hook

APPLICATION: This standard applies to wiring parts to a hook and taking them to the degreaser to be cleaned in the Plating Shop Bldg 225 under conditions in effect as of above date.

ANALYSIS: Operators are assigned to this work area by shop foreman and they in turn handle any job that is moved into the shop. These parts are transported to the worker by material handlers. The amount of parts to be wired to a hook will be determined by the size and weight of object. The parts in this study are 4 inches outside diameter and 1/32 inch thick. The weight is no problem. It was found that 3 each of these spacers could be wired to the hook. After parts are put in the degreaser the worker returns to bench and the operator who does the plating takes over. An allowance of 15 per cent has been added to all valves to cover personal rest and unavoidable delays.

WORK MEASUREMEN' ITHODS ANALYSIS CHART — REFERENCE NO. 1

PART: Spacer for Brake — DATE: 15 October 1958 — STUDY NO. 05
OPERATION: Ready parts for plating — ANALYST: O. Beard — PAGE 3 OF 8 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(A) Hook over to work area						
			20.1	R22B		To hook
			2.0	G1A		Pick up
			13.4	M12B		Move to work area
			2.0	RL1		Release
(B) Get wire to hook						
To hook to hold		R9B	15.8	R16B		To Wire
Grasp at hook end		G1A	2.0	G1A		Grasp Wire
Move hook out slightly		M10B	13.4	M12B		To hook
				G4		Ready to wrap around hook
			26.7	M6B	3	Wrap around hook
			11.2	G2	2	Regrasp each time around
			2.0	RL1		Release
			4.0	R2B		To end of wire to tighten
			2.0	G1A		Wire
			4.0	MFB	2	Loop end to secure
			16.2	AP1		Final tighten
Release hook		RL1	2.0	RL1		Release wire

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
A	Hook to work area	37.5	.000375	15	.000431	1	.00043
B	Get wire to hook	99.3	.000993	15	.001142	1	.00224
						TOTAL	.00157

AMC FORM 19 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMEN' ITHODS ANALYSIS CHART — REFERENCE NO. 2

PART: Spacer for Brake — DATE: 15 October 1958 — STUDY NO. 05
OPERATION: Ready parts for plating — ANALYST: O. Beard — PAGE 4 OF 8 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(C) Get part - To Wire 3 ea parts to wire						
To Wire at top		R4B	14.4	R14B		To Part
Hold wire at top to		G1A	3.5	G1B		Part
Receive part			12.9	M12A		Part up wire to other hand
Part from R.H.		G3	5.6			
			6.4	R4B		To Wire
			2.0	G1A		Gain Control
Hold			6.9	M4B		Move up side of part
			2.0	RL1		Release Wire
			6.4	R4B		Back to part
			5.6	G3		From left hand
Back to wire above part		R2B	4.0			
Grasp hold		G1A	2.0			
			28.2	T180S	3	Twist part on wire
			4.0	RL1	2	Release
			12.8	R4B	2	Back to part
			4.0	G1A	2	Gain Control
Release		RL1	2.0	RL1		Final Release of part

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
C	Get part - wire to hook 3 ea parts to wire	122.7	.001227	15	.001411	1/3	.00423
						TOTAL	.00423

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APPLICATION IV

WORK MEASUREMENT THODS ANALYSIS CHART — ERENCE NO. 3

PART: Spacer for Brake — DATE: 15 October 1958 — STUDY NO. 05

OPERATION: Ready parts for Plating — ANALYST: O. J. Beard — PAGE 5 OF 8 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(D) Cut wire from spool of wire						
To Wire		R10B	14.4	R14B		To wire cutters
Grasp and hold		G1A	2.0	G1A		Pick up
			14.6	M14B		To Wire
				G2		Gain Control
				M3B		Open pliers
			5.6	P1SE		Pliers to Wire
			4.9	M3A		Close pliers down to wire
			16.2	AP1		To Cut
			2.0	MFA		Make Cut
Release Wire		RL1	14.6	M14B		Aside pliers
			2.0	RL1		Release
(E) Move Hook to edge of bench ready for degreaser						
			15.8	R16B		To hook
			2.0	G1A		Grasp Hook
			23.1	M28B		Move to edge of bend
				G2		
			5.6	P1SE		On bench edge
			2.0	RL1		Release
			9.9	R9E		Back to start

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
D	Cut wire from rack	76.3	.000763	15	.000877	1	.00088
E	Move hook to edge of table ready for degreaser	58.4	.000584	15	.000672	1	.00067
						TOTAL	.00155

AMC FORM 10 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMENT THODS ANALYSIS CHART — ERENCE NO. 4

PART: Spacer for Brake — DATE: 15 October 1958 — STUDY NO. 05

OPERATION: Ready parts for Plating — ANALYST: O. Beard — PAGE 6 OF 8 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(F) Parts from table to Degreaser Pick one up in each hand						
			43.4	STD		Stand
			34.1	SS12C2		Side Step to Hooks
To Hook on table		R8B	10.1	R8B		To hook on table
Pick up one hook		G1 A	2.0	G1A		Pick up one hook
Move from edge of table		M10B	12.2	M10B		Move from edge of table
			18.6	TBC1		Toward aisle to degreaser
			408.0	W24PO		To Degreaser
			18.6	TBC1		At degreaser
			18.2	M20B		To Rod in degreaser
			4.9	M3A		Hook down over Rod
			2.0	RL1		Release

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
F	Parts from table to degreaser	572.1	.005721	15	.006579	1	.00658
						TOTAL	.00658

AMC FORM 10 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMENT THODS ANALYSIS CHART — ERENCE NO. 5

PART: Spacer for Brake — DATE: 15 October 1958 — STUDY NO. 05

OPERATION: Ready parts for Plating — ANALYST: O. Beard — PAGE 7 OF 8 PAGES

DESCRIPTION - LEFT HAND	NO.	LH	TMU	RH	NO.	DESCRIPTION - RIGHT HAND
(G) Return to Bench ready to Work						
			18.6	TBC1		Toward Bench
			408.0	W24PO		To Bench
			37.4	SS15C2		to Front of Chair
			29.0	B		Bend and Reach side
Same motions for left hand						of Chair
			2.0	G1A		Grasp sides of Chair
			34.7	Sit		Sit pulling chair forward
			9.5	LM8		Right leg forward
			9.5	LM8		Left leg forward
			2.0	RL1		Release chair
		R10E	10.5	R10E		Ready to Work

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
G	Return to bench to start new operation	561.2	.005612	15	.006454	1	.00645
						TOTAL	.00645

AMC FORM 10 MAY 55 142AL (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

WORK MEASUREMENT OPERATION SUMMARY

PART: Spacer for Brake Disc — DATE: 15 October 1958 — STUDY NR 05

OPERATION: Ready Parts for Plating to Degreaser — ANALYST: O. Beard — PAGE 8 OF 8 PAGES

NR	ELEMENT DESCRIPTION	ANALYSIS CHART REF	ELEMENT TIME TMU	CONVERSION FACTOR .00001 LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
A	Hook to work area	1	37.5	.000375	15	.000431	1	.00043
B	Get Wire - to hook	1	99.3	.000993	15	.001142	1	.00114
C	Get part - wire to hook - 3 each parts to wire	2	122.7	.001227	15	.001411	3/3	.00423
D	Cut wire from spool of wire	3	76.3	.00763	15	.000877	1	.00088
E	Move hook to edge of table ready for degreaser	3	58.4	.000584	15	.000672	1	.00067
F	Parts from table to degreaser	4	572.1	.005721	15	.006579	1	.00658
G	Return to bench to start new operation	5	561.2	.005612	15	.006454	1	.00645
							TOTAL TIME ALLOWED PER	.02038

AMC FORM 19 MAY 55 142AN (REPRODUCED BY PERMISSION OF THE METHODS ENGINEERING COUNCIL)

PITTSBURGHER BECOMES FOURTH AMERICAN TO BE ELECTED A FELLOW OF THE INTERNATIONAL ACADEMY OF MANAGEMENT

Dr. H. B. Maynard, president, H. B. Maynard and Co., Inc., management consultants, with headquarters in Pittsburgh, Pa., and one of the founders of the MTM Association as well as an honorary life member, has been elected a Fellow of the International Academy of Management in Athens, Greece, it is announced by Professor Erwin H. Schell, chancellor of the academy. He is the fourth American to receive this honor, among the 26 nations of the Western World participating in the academy, according to Dr. Schell.

"Election as Fellow of the Academy," the citation reads, "is in recognition of distinguished services rendered to the science of management." Other Americans selected for membership include Dr. Lillian M. Gilbreth, originator with her late husband of the motion study technique and also "Cheaper By The Dozen" fame, (popular best selling novel which tells her life story); Mr. Peter R. Drucker, well-known American economist and author; and Dr. Schell, who now heads the academy.

The academy was formed ten years ago as a means to research management information and knowledge and to disseminate it throughout the Western World. The academy acts as a subsidiary division of the International Committee for Scientific Management of Paris, France.

Dr. Maynard, according to the academy report, has made outstanding contributions in management to the fields of engineering, organizations, sales, and marketing. He is author of six industrial books, is editor of the McGraw-Hill Industrial Engineering Handbook, and was recently selected as author of their Top Management Handbook.

MTM COURSE SUCCESSFULLY COMPLETED; FOUR STUDENTS GRADUATE WITH HONORS

SUCCESSFUL COMPLETION—Phil J. Douros, Albert D. Saunders, Gerald B. Westlund, Adolph E. Anderson, who achieved "A" grades in MTM Applicator's course are congratulated by Lt. Col. G. K. Parker, Director, Administrative Division.

The four civilians pictured achieved grades of "A" in the MTM Applicator's Course recently conducted at the College of Mojave. They have received a Certificate of Recognition certifying that they have successfully completed the Application Training Course in Methods-Time Measurement given by the U.S. Marine Corps at Barstow. Further, that this course has been investigated and approved by the MTM Association for Standards and Research. Methods-Time Measurement is defined as a procedure which analyzes any manual operation or method into the basic motions required to perform it and assigns to each motion a predetermined time standard which is determined by the nature of the motion and the conditions under which it was made.

The MTM technique is being applied to Storage Branch operations in the Material Division and to Maintenance Branch operations in the Services Division.

The predetermined time value obtained from MTM data is defined as the time required for an average worker with average skills working at an average rate of speed to perform industrial work in accordance with a prescribed method.

The standard thus developed when combined with adequate allowances for fatigue, personal needs, etc., is fair in all respects if it is properly developed. The holder of an MTM certificate possesses the skill to properly apply MTM data to develop a fair standard.

However, the standard is accurate only so long as the exact prescribed method is followed. If the worker insists on following an inefficient motion pattern, he cannot meet the standard no matter how hard he works.

On the other hand the average worker with average skill following the prescribed method but exerting good effort can expect to exceed the standard by as much as 20%.

In other words, if the standard is 100% he can produce at a rate of 120% day after day without fear of physical injury. Under an incentive pay plan such performance becomes commonplace.

IN MTM APPLICATOR'S COURSE

(L. to R.) Edward J. Peters, Ross W. Farr, Adolph E. Anderson, Eric N. Sherbourne, Herbert J. Vatcher, Jack R. Robbins, ActGySgt. Kenneth Will, Jr., Philip K. Badger, Gerald B. Westlund, Vearl Day, Phil J. Douros, Myron W. Lough and D. W. DeVoss, Instructor. Not shown in photo are Ralph L. Parker, Albert D. Saunders, Jr., and Earle C. Palmer.

The Methods Time Measurement course, which began April 20, is of three weeks' duration. Upon successful completion of the final examination, the students will receive an MTM Applicator's Certificate from the National MTM Association for Standards and Research.

Among the many large industries belonging to the Association are International Business Machines, General Electric, Sears, Roebuck and Co.

The Naval Shore Establishment and the Air Force use MTM extensively in their various industrial-type activities. The feature article of the April issue of "Factory" magazine predicts "use of predetermined time standards (MTM) will double in the next five years."

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RESEARCH REPORTS

R.R. 101 Disengage

This report contains a preliminary study of the element disengage. While it is still classified as tentative, the report contains some extremely interesting conclusions on the nature and theory of this element.

R.R. 102 Reading Operations

The first step in the use of MTM for establishing reading time standards is contained in this report. In addition, the report contains a synopsis of the work done in this field by 11 leading authorities.

R.R. 104 MTM Analysis of Performance Rating Systems

A talk presented at the SAM-ASME Time and Motion Study Conference, April 1952. It contains an analysis of performance rating systems and various performance Rating Films from an MTM standpoint.

R.R. 105 Simultaneous Motions

This report represents almost two man-year's work on a study of Simultaneous Motions. It is a final report of the Simultaneous Motions project undertaken by the MTM Association. While it does not purport to provide complete and exhaustive answers to all problems in the field of Simultaneous Motions, it presents a great deal of new and valuable information which should be of interest to every MTM practitioner.

R.R. 106 Short Reaches and Moves

This report contains an analysis of the characteristics of Reaches and Moves at very short distances. It develops important conclusions concerning the application of MTM to operations involving these short distance elements.

R.R. 107 A Research Methods Manual

The research activity of the Association has developed an effective and comprehensive set of methods for carrying on research in human motions. This report details the major techniques used. Adequate sources of motion data, film analysis, data recording, and statistical methods of analysis are among the topics discussed.

R.R. 108 A Study of Arm Movements Involving Weight

In this report, the results of a large investigation into the effect of weight on the performance times of arm movements are presented. While more effective means of determining correct time allowances for moving weights are given, the comprehensive discussion of the whole area of weight phenomena is probably of more fundamental importance. The effect of such conditions of performance as the use of one or two hands, sliding vs. spatial movements, and male and female performance are among the topics presented.

R.R. 109 A Study of Positioning Movements

I. The General Characteristics. II. Appendix.
This report, the first of two position reports, defines "positioning movements and the interrelation of component movements." The study is limited to the laboratory analysis, and contains an appendix dealing with several subjects outside the major objectives.

R.R. 110 A Study of Positioning Movements

III. Application to Industrial Work Measurement.
This report, the second on position, relates the results of the position research to the field of application. This study deals with actual industrial operators and work measurement tools, and the evolution of an improved and more efficient technique for controlling and improving manual activity through better understanding of positioning movements.

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